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95th Congress }
2d Session }

JOINT COMMITTEE PRINT

CHINESE ECONOMY POST-MAO

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A COMPENDIUM OF PAPERS

SUBMITTED TO THE

JOINT ECONOMIC COMMITTEE
CONGRESS OF THE UNITED STATES

Volume 1. Policy and Performance

NOVEMBER 9, 1978

Printed for the use of the Joint Economic Committee

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LETTERS OF TRANSMITTAL

October 31, 1978.

To the Members of the Joint Economic Committee:

Transmitted herewith for use by the Joint Economic Committee, the Congress, and the interested public is a survey and analytical study of the economy of the People's Republic of China entitled "Chinese Economy Post-Mao." This is a compilation of invited papers designed to meet the interests of the committee and the Congress in an up-to-date body of factual data and interpretative comment on the state of the domestic economy of China, including the record of its recent experience in economic development and its relations with the outside world.

Early in the Great Proletarian Cultural Revolution the Joint Economic Committee released a pioneering, two volume assessment entitled "An Economic Profile of Mainland China" (1967). As the People's Republic of China began to relate more with the world community through its membership in the United Nations and in opening relations with the United States it seemed appropriate to supplement the earlier study by an updated volume that also reflected these changing relations of China with the outside world. Therefore the "People's Republic of China: An Economic Assessment" was released by the committee in 1972.

In the wake of U.S. withdrawal from Indochina, it was especially timely that we review all aspects of our policy with the People's Republic of China. Many Members were fortunate enough to travel to China and talk with the Chinese leaders first hand. The comprehensive volume released in 1975, "China: An Economic Reassessment" proved highly useful in those meetings.

With the deaths of Mao Tse-Tung and Chou En-lai, two giants of the Chinese Communist revolution left the scene. The new leaders Hua Kuo-feng and Teng Hsiao-ping initiated a new period of Chinese economic policy and development.

China, the largest nation in the world, is a major factor in world stability. Certainly, the Chinese economy is a subject of primary concern, and we have an obvious and compelling need of knowledge on the subject. This extensive compilation was organized in the hope that it will serve this need. It covers all of the major aspects of the Chinese economy and should provide a valuable source book for further committee studies on the subject, use by other committees and Members in trips and studies, for other government agencies and the general public.

Our earlier volumes provided a factual basis for better understanding of the economy of China. We hope this volume will not only update these earlier efforts, but provide a current reassessment. The sources of information on China are still limited but better than during the earlier studies.

It is hoped that this volume, drawing on research at universities, research institutions and in the Federal Government, will serve as an aid and a stimulus to all scholars working on this subject. The committee is deeply indebted to the scholars from Government and academia who gave so generously of their time and expertise to the committee. They are listed in the executive director's memorandum to me, and I would like to take this opportunity on behalf of the committee to express our gratitude for their invaluable efforts without which this study would not have been possible.

Finally, we wish to take this opportunity to express our gratitude to the Congressional Research Service for making available the services of John P. Hardt, who helped to plan the scope of the research and coordinated the contributions for the present study, with assistance from Ronda Bresnick.

It is understood that the views contained in this study are not necessarily those of the Joint Economic Committee nor of individual members.

RICHARD BOLLING,
Chairman, Joint Economic Committee.

OCTOBER 24, 1978.

Hon. RICHARD BOLLING,
Chairman, Joint Economic Committee,
U.S. Congress, Washington, D.C.

DEAR MR. CHAIRMAN: Transmitted herewith is a volume of materials on the economy of the People's Republic of China entitled "Chinese Economy Post-Mao." The study has been prepared in the form of a symposium containing a series of selected papers contributed by invited specialists who are recognized authorities on China. The specialists in question have been drawn from the ranks of the universities here and abroad, private research institutions and the several departments of the Federal Government and the Library of Congress. The papers they have submitted, in response to our request, cover a broad range of topics dealing with the recent performance of Chinese economy. Included are economic policy, the defense burden, agriculture, transportation, industry, population, the environment, technology transfer, international trade, financing, and foreign trade.

The Joint Economic Committee undertook an earlier study, the two-volume "Economic Profile of Mainland China," to provide a basic body of information on the economy of Communist China. In 1972 the committee released a compendium entitled "People's Republic of China: An Economic Assessment." This was followed in 1975 with "China: An Economic Reassessment."

The current study is intended to supplement the earlier studies by a presentation of information and analysis that has become available to the various Government agencies during the last several years.

It is hoped, furthermore, that the facts and ideas presented in this survey of available information will help to shed light on the alternatives facing the United States in ordering our relations with the People's Republic of China within the foreseeable future. The shape of these relations is certain to be significant both for the internal development of China and critical to the issue of war and peace in the world.

The contributors to the study have been most considerate of our needs and generous in giving of their time and expertise to provide not only basic information but indispensable analytical perspective on this important subject. The individual scholars who have participated in the preparation of the present study are:

William B. Abnett
John S. Aird
Arthur G. Ashbrook, Jr.
Martha Avery
Richard E. Batsavage
Nai-Ruenn Chen
William Clarke
Gordon Cole
Jack Craig
John L. Davie
Robert F. Dernberger
Alexander Eckstein
David Fasenfest
Robert Michael Field
Carol Fogarty
Henry J. Groen
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Jon Sigurdson
Vaclav Smil
Frederic M. Surls
Robert E. Teal
Marina Thorborg
K. P. Wang
William W. Whitson
Thomas B. Wiens

In addition, the committee received the wholehearted cooperation from the following agencies of the Government, private research institutions, and universities:

Bureau of East-West Trade, Department of Commerce.
Bureau of the Mines, Department of the Interior.
Congressional Research Service, Library of Congress.
Economic Research Service, Department of Agriculture.
Foreign Demographic Analysis Division, Department of Commerce.
Heller, Ehrman, White and McAuliffe, Attorneys at Law.
Intelligence and Research Division, Department of State.
Research Division, Library of Congress.
Department of Geography, University of Manitoba, Canada.
Mathematica.
Scandinavian Institute of Asian Studies, Denmark.
St. Anthony's College, Oxford, England.
University of Uppsala, Sweden.
Department of Economics, Yale University.

It should be clearly understood that the views expressed in these papers are those of the individual contributors and do not necessarily represent the positions of the respective executive departments, the Joint Economic Committee, individual members thereto, or the committee staff.

The Library of Congress made available the services of John P. Hardt, senior specialist in the Congressional Research Service, who helped to plan the scope of the research and to coordinate the contributions for the present study. Ronda Bresnick of the Congressional Research Service assisted Dr. Hardt in this task.

We are indebted to Prof. Robert. F. Dernberger from the University of Michigan who conducted with Dr. Hardt several author workshops during the course of the preparation of the volumes that contributed to its quality and integration. Professor Dernberger also assisted in organizing and conducting critical workshops related to both volumes of this publication. The first volume is entitled "Chinese Economy Post-Mao: Volume I. Policy and Performance." And the second volume, to appear later, is entitled "Chinese Economy Post-Mao: Volume 2. Recomputation of Chinese National Accounts." This second volume is largely the coordinated effort of R. Michael Field of the Office of Economic Research, CIA, with support from K. C. Yeh of Rand Corp.

We are grateful to Mrs. Ruth Eckstein and the Cambridge University Press for permitting us to reprint a chapter from the last book of her late husband Prof. Alexander Eckstein of the University of Michigan, "China's Economic Revolution."

JOHN R. STARK,
Executive Director, Joint Economic Committee.

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SUMMARY

By John P. Hardt

The post-Mao period seems to be dominated by a pragmatic economic policy which is exemplified by the drive for the "four modernizations": in agriculture, in industry, in national defense and in science and technology. The current goal, first enunciated by Chou En-lai in the 1960's, is to convert China into a powerful and prosperous nation by the year 2000. While Mao is still shown great respect, under the joint leadership of Hua Kuo-feng and Teng Hsiao-ping (the man Chou selected to be his successor) Maoist ideology has been deemphasized and the adverse effects of the Cultural Revolution on education, on science and technology and, consequently, on economic growth, are now readily acknowledged. The current focus on economic modernization, technological change, professionalism and measured ties to the Western developed economies may now be seen at all levels of Chinese policy and life. Although the rapid, thoroughgoing pursuit of the letter and spirit of Chou's vision is a fact of post-Mao China, most authors remind us that we may be seeing yet another policy cycle which, under Mao, alternated from periods stressing ideology to periods emphasizing economic priority and pragmatism. No one can predict, for example, whether the policies of modernization will be able to survive the passing of 73-year-old Teng Hsiao-ping, generally regarded as the instigator and implementor of China's push for modernization. Trend or cycle, the Chinese economy and society are in the throes of significant and interesting changes.

This volume follows three earlier compendia on the Chinese economy: "Economic Profile of Mainland China" (1967); "People's Republic of China: An Economic Assessment" (1972); and "China: A Reassessment of the Economy" (1975).

Hearings related to some of those earlier volumes were also published. The current volume updates and expands the coverage of the earlier publications. The 37 contributors number more than any of the previous volumes. The participants represent academic institutions in the United States, Canada, the United Kingdom and Sweden, various departments of the U.S. Government and research institutions.

A companion volume to this entitled "Recomputation of Chinese National Accounts" will be published separately by the Joint Economic Committee.

This compendium is organized into five sections: Policy Perspectives; Manufacturing and Extractive Industries; Population and Labor Utilization; Agriculture; and Foreign Economic Relations. Some of the major questions addressed in the studies, with indications of some of the authors' responses are illustrated below:

Question 1. What are reasonable projections of China's economic future? Has the economy of the People's Republic of China settled down to a stable, continuous process of economic growth?

. . . all of the papers in this volume recognize the record of positive rates of growth in both agriculture and industry in China's economic development over the past 28 years, which have created a significant economic base for the new leadership to build on in their attempt to modernize China's economy. More important, all recognize the tremendous potential for future growth and even the more pessimistic of the papers that follow believe the new leadership's economic plans and policies will achieve a considerable degree of success, i.e., further increases in GNP per capita. Perhaps most important of all is that these economic plans and policies of the new leadership indicate domestic economic rationality and stability and a far greater reliance on normal commercial relations with the industralized countries of the non-Communist world than was true in the past. [Dernberger-Fasenfest, p. 47.]

By examining historical growth rates some conclusions on Chinese economic development have been drawn.

This growth tabulation clearly shows the general pattern of economic development, that is, the rapid increases in industrial output, while grain output barely keeps up with population. While the data are not accurate enough to put much weight on this distinction, the main point remains firm—grain output in China has been roughly matching population growth over the long haul.

Several important factors argue for substantial economic growth over the 8 remaining years of the recently announced 10-year plan:

1. The investment of one-quarter of GNP to rapidly build up the nation's productive capacity.
2. The continued existence of rural capital construction projects with a high payoff.
3. The renewed advances of industrial technology, bolstered by the Hua regime's greater acceptance of foreign equipment and its revitalization of domestic science and higher education.
4. The continued restraint in the allocation of high-technology resources to military industries.
5. The potential for further striking gains from foreign trade, via the route of comparative advantage.
6. The continued rise of per capita consumption in a variety of small ways, a trend that permits greater experimentation with material incentives.
7. The existence of an effective and low-cost administrative apparatus for reducing population growth still further, thus reducing pressures to shift resources from investment to consumption.
8. In general, the apparent settlement of leadership issues and the ascendancy of the economic modernizers at the expense of the militant ideologues.

Formidable as these progrowth forces seem, they do not guarantee a continuation of 5½-percent GNP growth and 9-percent industrial growth through 1985. While the short-term potential for high growth rates is quite promising because of sizable "catch-up" possibilities, the longer term prospects are for a drifting down of the GNP and industrial rates as opposed to the increases envisioned in the new plan. [Ashbrook, pp. 227–228.]

The primary causes of China's declining economic performance since 1974 appear to be short term and political in character rather than long term and structural. The adverse influence of these short-term elements appears to have receded rapidly, due largely to the decisive actions taken by the new government since late 1976. However, even if we could confidently assume future political stability, the target rates of growth included in the 10-year plan remain quite ambitious . . . . The possibility of slightly better future performance cannot be ruled out since the 1964–74 decade included the cultural revolution that had a significantly adverse effect on industrial production and investment. . . .

A return to economic performance similar to that of the 1964–74 decade, however, is dependent on two crucial conditions. First, there must be a stable political environment that is conducive to long-run economic planning. In the absence of automatic mechanisms for determining the allocation of resources, these decisions are made through a direct political process that is extremely vulnerable to disruption. If the political consensus that appears to underlie the 10-year plan should be shaken, there could be a renewed paralysis of the planning process, a deferral of investment decisions, and a decline in the rate of growth.

A second condition for the resumption of sustained growth is the deferral of modernization of China's military establishment. The underlying scarcity of resources and the envisaged increase in the flow of investment to improved social services and transportation infrastructure; to scientific and technical modernization; as well as to industry and agricultural implies that the share of resources allocated to the military cannot be increased substantially. China's national defense is still to be modernized by the end of the century. But high resource costs and technical difficulties will mean that an across-the-board modernization program will have to be deferred well into the 1980's if goals in other sectors are to be met. This will not preclude either a rising absolute level of defense expenditure or significant improvements in selected weapons systems, but a systematic modernization program will depend on a more developed industrial sector. [Lardy, pp. 60–61.]

Question 2. How do the political dynamics post-Mao influence future economic policy? Will this changing political pattern change the character of the Chinese development model formulated under Mao's rule?

Guided at home by a search for "moderate" policies, abroad the regime likewise sought means for defining and maintaining an appropriate "political distance" between China and the three major Asian powers. In that endeavor, China's leaders clearly had fewer levers and resources at hand than they had at home. Abrupt changes in the perceived structure of power in Asia or the process whereby crises might be resolved could upset China's economic plans through the workings of the domestic political process. Radical opposition might use such change to mobilize a new coalition of power among impatient younger military leaders, frustrated rural youth and idealists threatened by Teng's new class of professionals to demand still another turn of China's political cycle.

In the light of the past 25 years of change in China, the odds seemed to favor such a shift in Chinese political style before 1980, probably having the effect of constraining the authority of central leadership, increasing the role of the military both in Peking and in the provinces, accelerating military modernization with a consequent delay in the achievement of economic goals, and bring another round of domestic political instability. Unless foreign powers were willing to commit substantial political and economic resources, such changes on China's domestic political stage could not be influenced very much by any single power's Asian policies. Only Soviet determination to go to war with China or American determination to support China in such a war might overwhelm the otherwise independent dynamic of China's internal political system. [Whitson, pp. 78–79.]

Question 3. How do foreign perceptions of the performance and rationale for the Chinese economic model differ? How, specifically, has China's erst-while ally—the Soviet Union viewed the Chinese development?

According to Western perceptions, the future of Chinese economic development remains uncertain but carries great potential.

. . . in a post-Mao-Chou era, power struggles and policy disputes—including economic policy differences—could become seriously aggravated. Therefore, it may be particularly difficult to forecast the future course of China's economic policy. Nevertheless, barring a repetition of great leap forward—or cultural revolution-type measures of China's involvement in a major international conflict, the country should be in position to sustain over the coming decade approximately the same average rate of economic growth as in the past 25 years. This would mean that by the end of this century China's gross domestic product could be quadrupled. In terms of total size it would still lag far behind the United States and the Soviet Union, but could easily be among the five largest economies in the world.

Nevertheless, just as in the past, it will be no easy task to sustain a 6-percent rate of growth. Based on past performance, this will require a rise in farm production of about 2 to 3 percent a year assuming (1) a continued commitment to basic self-sufficiency in food supply, and (2) a rate of population growth of not less than 1.5 to 2 percent a year. This will necessarily pose a major challenge to Chinese agriculture. Over time it will require very large investments in the farm sector and its far-reaching technical transformation. It is far from clear whether such a major transformation can be accomplished within present patterns of economic organization and employment in agriculture. This range of issues will necessarily constitute one of the continuing problems facing the Chinese Communist leadership for the rest of this century and probably beyond.

The successor generation of China will also have to face up to the challenge of sustaining the revolution, its values and spirit, in the processes of production are bound to become more complex. Technical training requirements may also be expected to grow, thus posing a number of dilemmas. Will the educational system as reorganized after the cultural revolution be capable of training the advanced engineering, scientific, and technical manpower required for an industrial society.

If not, can that system be reshaped in such a way as to continue producing "reds" and "experts?" Can status and income differences be fairly narrowly confined in the face of the growing specialization, division of labor, and functional differentiation associated with industrialization?

Another and closely related range of questions revolves around consumer aspirations. With a fairly rapidly rising product, can household purchasing power in the cities and in the countryside be kept stable or rise only quite slowly and gradually? Alternatively, will increasing product be gradually translated into increasing consumer appetites? Can consumerism be contained and the spirit of frugality and self-abnegation be preserved?

It is also very unclear whether China can maintain a 10-percent rate of industrial growth for several decades with a preponderantly rural population. This of course will crucially depend on the pattern of industrialization, that is, the technologies used, the scale of plant, and the degree of capital intensity. It may also depend on whether it is possible to design a highly decentralized pattern of industrial development in China that would economize on transport and be partly regionally based. Such a pattern might slow down the rate of urbanization and at the same time alleviate some of the dilemmas posed above.

In essence, the fundamental challenge confronting China's leaders in the coming decades will be to maintain the tempo of economic growth, to build a strong and modernizing China, while preserving socialist values and not only socialist forms of organization. It remains to be seen whether China can become a modern industrial state without perpetuating the "new class" that has been gradually emerging since the 1950's and without following the "revisionist" road. If China's far-reaching experiment were to succeed, it would indeed be a historic contribution to the process of modern economic growth. [Eckstein, pp. 113–114.]

The Soviet view of Chinese economic development has been somewhat different from Western or Chinese perceptions.

Soviet Sinologists have to contend not only with a paucity of data (a problem familiar to all China specialists), but also with the ideological and political constraints, which limit their freedom . . . [p. 116].

In reviewing their aid to China, the Soviets conclude that it is the assistance they provided in the 1950's which made it possible for China to experience early successes and which also turned the head of Mao and his entourage, fanned their great-power hegemonistic aspirations and served as fertile ground for nationalistic tendencies in the Chinese leadership . . . [p. 133].

Undoubtedly the most important theme recurring in Soviet texts on China contends that militarization is the primary characteristic and the foremost priority of China's economy . . . [p. 139].

. . . there seems to be little doubt that most Soviet economists believe that Peking neglects rural development, that state aid is available only in periods of crisis, that local self-sufficiency is a ridiculous policy and that military priorities are the cause of China's poor agricultural performance . . . [p. 144].

The Soviets describe the development of China's industry as complicated and contradictory . . . [p. 148].

While Chinese industry (both national and local) had experienced growth in the 1970's, Peking has not been able to solve many of the fundamental problems that affect industrial development, such as insufficient raw materials and energy, outdated industrial facilities, and the shortage of qualified specialists . . . [p. 148].

The simultaneous development of modern and traditional means of production runs counter to the Soviet passion for bigness . . . [p. 138].

Although Soviet and Western estimates of China's production figures may differ, there is actually little disagreement about the over-all strength and weaknesses of individual economic sectors or the specific problems facing the planners in Peking. The differences are in perspective, in emphasis, and in evaluations of the rationality (or muddleheadedness) of China's economic policies . . . [pp. 148–149].

In discussing PRC's most recent drive for modernization, the Soviets say that the new policies are nothing more than "the adaptation of Maoism to altered conditions". . . [p. 134].

"The Soviets themselves recognize and even publicly admit some of the problems and weaknesses in their research on the PRC . . ." [but] "it is very important not to lose sight of the great improvement that has taken place . . . since the beginning of this decade.". . . "Unencumbered by political demands for conformity, free to pursue their research and arrive at independent conclusions, Soviet Sinologists should be able to move to the forefront of studies on modern China. If this day ever comes, it will behoove Western China-watchers to pay much closer attention to what their Soviet counterparts may start saying or writing about China." [Orleans, p. 164.]

Question 4. What is the Chinese policy on economic modernization? What are the prospects for the Chinese economy in this post-Mao period?

China's economic modernization efforts may be influenced by a number of constraining factors. The speed of economic growth during the balance of the century will depend largely on the ability to remove or minimize the impact of these constraints. Some of them are ideological, political, or institutional in nature while others represent bottlenecks in the economy.

On the ideological front, although the post-Mao leadership has shown flexibility in interpreting the self-reliance principle, changes are likely to be gradual and slow. Further, certain basic tenets are expected to remain inflexible. As long as the preclusion of foreign direct investment in China continues to be one of these tenets, China deprives itself of the benefit that, as the experience of many developing countries has shown, foreign capital could contribute to economic modernization. But a much broader ideological constraint lies in the likelihood of a recurrence of the "two-line struggle." The development of China's economy under Mao showed a deep-seated conflict between ideology and the economic and technical realities of the country leading to a cyclical pattern of economic growth. The Hua government has launched an intense rectification campaign to purge the followers of the "gang of four" at all levels in an attempt to alleviate such a conflict. But it remains to be seen if economic success in the post-Mao era can continue for a prolonged period of time without giving rise to a group of "neo-radicals" to seriously challenge the pragmatic leadership and/or its economic policies.

The failure to stave off such a challenge could greatly jeopardize the political stability which would be absolutely essential to the success of China's modernization efforts. In the short run, political stability also depends on the cohesiveness of the various elements that have made up the post-Mao leadership. . . .

Economically, the greatest bottleneck lies in the agricultural sector. The success of the four-modernizations program will hinge critically on the Chinese ability to expand agricultural output considerably faster than population growth. . . .

Certain other economic sectors, particularly electric power and transport, have developed into major bottlenecks brought about by years of relative neglect in investment allocation. The slow progress of these two sectors, considered as "vanguards" in the Chinese economy, is likely to constrain China's industrial growth in the immediate years ahead. To assure rapid industrial expansion in the 1980's will require power and transport to grow more rapidly than industry as a whole.

In 1976, the five major powers combined accounted for 70 percent of the world's GNP. Of these five major powers' total GNP, China's share in 1976 was only 6.7 percent; it produced less than one-fifth of the level of the world's largest producer, the United States, and some 60 percent of the level of fourth largest, Japan. A successful modernization drive in China could increase its share to 8 to 9 percent by 1985 and 10 to 14 percent by the year 2000. With the most optimistic estimate, China's GNP would still rank last among the five major powers by the end of the century, but could reach over half of the U.S. level and more than 70 percent of the Japanese or Soviet level. [Chen, pp. 200–203.]

Question 5. How did the interrelations of political and economic factors affect industrial growth in the decade or so prior to the establishment of current leadership policy?

. . . Whatever the initial goals of the Fourth 5-Year Plan, it is clear that the revisions gave increased priority to industrial support of agriculture and to expansion of exports. Thus, Peking had to defer grappling with the structural imbalances that were holding down the growth of industry.

These fundamental economic problems were soon complicated by a new wave of political trumoil. As Mao grew old and frail, the struggle for succession broke into the open. The campaign to criticize Lin Piao and Confucius (late 1973–74) quickly made itself felt throughout industry. Production dropped far below planned output and by midyear 1974 the situation was serious enough for the central committee to issue directive No. 21, which focused on economic difficulties caused by the excesses of political campaign. The situation improved in the fall when Peking applied the brakes to the campaign to criticize Lin Piao and Confucius, but the rate of growth for the year was only 4.5 percent.

The year 1975 began on an upbeat, with Premier Chou En-lai making a key speech to the Fourth National People's Congress in January, calling for a vigorous modernization of the economy. During the first half of the year, the industrial sector responded well to positive actions taken by the Government to restore order in the wake of the campaign to criticize Lin Piao and Confucius. Nevertheless, the lack of strong production claims from such critical sectors as electric power and iron and steel suggest that the rate of industrial growth tapered off during the year and that any gains were largely based on recovery in the most disrupted areas and enterprises. . . .

The prospects for real progress in 1976 were shattered by the death of Premier Chou En-lai in January, which led to the intensification of the struggle for succession. The raging political storm did not have an immediate impact on industry. During the first quarter, output increased 13 percent over the corresponding period of 1975. But industry faltered during the second quarter, and collapsed in the third. The collapse was made worse by the devastating Tangshan earthquake in July which leveled the city of Tangshan, caused major damage in Tientsin and was felt as far away as Peking. More than 650,000 people were reported killed and billions of dollars' worth of damage was done; moreover, relief and reconstruction preempted normal production and construction activity in other areas of the country.

The death of Chairman Mao in September was quickly followed by the purge of the "Gang of Four" in early October. And later that month, the central committee issued central directive No. 19, which called for strong measures against slowdowns and absenteeism and for a careful accounting of funds available for investment. In spite of these positive actions, industrial production for the year as a whole grew only slightly more than 2 percent.

Peking hoped that 1977—the first year following the purge of the radicals—would show a healthy recovery and provide a firm basis for accelerated growth during the remainder of the Fifth 5-Year Plan period. . . .

Dissatisfaction with the pace of recovery probably figured in the decision in July to reappoint Teng Hsiao-ping to his post in the Government and party. And it is certainly reflected in State Planning Commission Chief Yu Ch'iu-li's statement in late October to party and state cadres that, although "the tide was turning" on the economic front, many difficulties remained.

The findings of the previous section show that politically stable Provinces tended to achieve moderate or strong industrial growth during the mid-1970's, and that politically unstable Provinces—with only one exception—failed to do so. Because the Cultural Revolution (1966–69) was also a period of political instability during which industrial output declined sharply . . ., the two periods are compared in this section.

Mao Tse-tung launched the Cultural Revolution because of his dissatisfaction with what he felt was the growing ossification of the party and Government bureaucracies, and his belief that China's youth required a "revolutionary experience", to renew their faith in a revolution that had taken place before most of them were old enough to participate or even remember it. With the power struggle that broke out between the "radicals" (led by K'ang Sheng, Ch'en Po-ta, and Lin Piao) and the "moderates" (led by party bureaucrats Lin Shao-ch'i and Teng Hsiao-p'ing), the Cultural Revolution quickly became one of modern China's most chaotic periods. The Chinese Communist Party virtually disappeared as an institution, and the turmoil grew so great that PLA main-force units were ordered to restore order in many Provinces and to assume control of a dozen. The economic consequences of the Cultural Revolution were especially serious in the industrial sector, where fractional struggles in the factories and disruptions along the transportation routes caused production to decline precipitously and to remain below trend for 3 years. [Field, McGlynn, and Abnett, pp. 243–244 and 254-255.]

Question 6. How are key industries such as machine building performing to meet the needs of modernizing China?

Chinese leaders have frequently claimed that the machine-building industry is the key to technological transformation of the national economy. Indeed, the industry forms the foundation of China's military and industrial development—encompassing a broad spectrum of manufacturing trades, ranging from production of ball bearings to ships, locomotives, power-generation equipment, and the like. As outlined in Chairman Hua's report to the Fifth National People's Congress of early 1978 China is launching an ambitious program to revitalize the economy through modernization of agriculture, industry, national defense, and science and technology. The stated goal is to create a modern industrial economy by the year 2000. Much of the burden of achieving this goal will fall on the machine-building industry. . . .

The core of China's machine-building industry was formed through the massive material and technical assistance provided by the U.S.S.R. and East European countries that began in 1953. During the first 5-year plan period (1953–57), out of the 166 major Soviet-aid projects in industry, nearly 100 were undertaken in the field of machine building. The U.S.S.R. supplied complete sets of equipment for plants and equipment, transportation equipment, agricultural machinery, chemical industry equipment and machine tools. Many of the remaining projects supplied by the Soviets formed the basis of China's military machine-building industry. In this important category were plants to produce aircraft, naval vessels, electronic equipment, land armaments, and nuclear weapons. Additional agreements with the U.S.S.R. and East European countries in 1958–59, nearly doubled the number of modern industrial plants planned for the machine-building industry.

Orderly development of the machine-building industry became impossible after the Great Leap Forward was launched in 1958. . . .

The machine-building industry retrenched with the rest of the economy from 1961–63. Production dropped sharply, capacity stood idle, and the regime pared down investment programs to a narrow range of essential industries. A new emphasis was given to the production of agricultural machinery, equipment for chemical fertilizer plants, and machinery for the petroleum industry. High priority moreover, was assigned to the military machine-building sector, particularly to electronics and those industries involved in the development of atomic energy, missiles, aircraft, and naval ships. By 1966 the general status of the machine-building industry had improved, production was well above the 1957 level. General improvement can be attributed to increasing imports of machinery and technology from Japan and Western Europe. . . .

Considerable dislocation in the machine-building industry occurred during the political turbulence of the Cultural Revolution (1966–69). Imports of equipment from the non-Communist world declined and technical exchanges were terminated. . . .

In spite of the disruptions of the Cultural Revolution, China achieved substantial increases in machine-building capacity during the late 1960's. Under the general slogan of "war preparation" the PRC engaged in a wide-ranging campaign to construct hundreds—and possibly thousands—of small, medium, and large-scale industrial projects throughout its remote interior regions. . . .

Reestablishing orderly economic planning, together with the additions to production capacity during the 1960's led to substantial increases in output during 1969–71. Production of military related equipment reached peak levels, and electronics emerged as a favored sector among military industrial planners. The small plant program, which had gained new respectability during the Cultural Revolution, reached boom proportions, while the construction of modern plants gained increased momentum. Self-reliance had become the watchword in the machine building industry, and new products of indigenous design began to emerge at a growing rate.

Evidence of a major debate between military and civilian planners over machine-building priorities surfaced in mid-1971. The "electronics versus steel" controversy, which signaled the debate, was quickly followed by the Lin Piao affair. Following the death of Lin, production of military armaments plummeted sharply from the peak levels of 1970–71. The marching orders for the industry during the fourth 5-year plan (1971–75) included increased support to agriculture and the basic industries such as mining, petroleum, chemicals, and electric power. Increased emphasis also was given to purchasing large quantities of Western equipment and manufacturing technology. [Craig, Lewek, and Cole, pp. 285 and 287–288.]

Question 7. What kind of constraints and stimulants do mineral and energy supplies and uses exercise on Chinese economic growth?

China is one of the world's rich mineral areas fully capable of supporting a modern first-rank industrial economy. During 1977, PRC strengthened its position as a leading mineral producer. Its relative importance should grow significantly in the decade ahead, judging from the resource potential and the many developments already underway. As befits a large country with a huge population. China produces a great variety of minerals and metals—many outstanding by world standards. If all minerals were added together in terms of output value, PRC would rank with the world's first five for crude minerals and only a little behind in terms of total value added for minerals and metals. [Wang, p. 374.]

Electric power is another key sector.

There exists a widespread shortage of electric power in the People's Republic of China (PRC) today that is adversely affecting the economy and which must be corrected quickly if the program to modernize industry, agriculture, science, and technology, and national defense is to be successfully implemented. Electric power is a "vanguard" industry which in a developing country like China must advance at a pace 1.3 or 1.4 times that of industry generally.

The shortrun solution to the power shortage is being sought in the fall 1977 directives of Chairman Hua calling for conservation, fuller utilization of existing generating capacity, and its more efficient operation. In the longer run China will place reliance on the continued development of both hydroelectric and thermal power stations. No nuclear stations are currently operative, but the Chinese will probably soon begin one. Although both large and small power stations will continue to be built, the greater emphasis will be placed on development of China's hydroelectric potential, the largest in the world. Currently, the PRC is the fourth largest producer of primary energy in the world after the United States, the Soviet Union, and Saudi Arabia.

In 1977, the PRC's electric power industry generated about 136 billion kilowatt-hours of power or 6 to 7 percent that of the United States. This was enough to place China ninth in power output. Installed capacity on December 31, 1977, was estimated to be 40,500 megawatts. The bulk of this capacity is found in the 192 known thermal and hydro stations of 30 megawatts capacity and over. Of these, 126 units are thermal stations and 66 are hydroelectric, some are currently under construction or are being expanded. Additional stations of this capacity or greater are thought to exist. About 62 percent of the capacity is thermal, the balance hydroelectric.

To adequately support a 10-percent rate of industrial growth, the power industry would need to add about 5,300 megawatts to capacity this year, a 13-percent rate of growth, and about 12,700 megawatts in 1985 to provide capacities of 45,800 and 108,000 megawatts, respectively. The domestic power equipment manufacturing industry, while quite substantial, does not appear capable of meeting this requirement. Thus, if a 10-percent industrial growth is to be achieved, Peking will have to import powerplants and equipment from abroad possibly expending as much as $300 million annually during the period 1978–85.

It does not appear that between now and 1980 the electric power industry can accelerate growth to the level to support a 10-percent industrial rate of growth 1978–80. It does seem possible, however, that by 1981 acceleration of developments in industry could support such industrial growth. To achieve this the Chinese will need to:

(*a*) Invest heavily in the development of the coal industry;

(*b*) Improve rail transport and develop "mine mouth" thermal plants to reduce coal hauling;

(*c*) Sharply reduce station construction times, especially on large hydro plants;

(*d*) Develop higher capacity transmission systems;

(*e*) Accelerate the development of 600-megawatt boilers and turbogenerators;

(*f*) Expand the domestic power equipment manufacturing industry; and

(*g*) Engage in a consistent and planned import of complete foreign powerplants and equipment. [Clarke, pp. 404–405.]

Chinese energetics presents a thoroughly intriguing, highly complex and, in not a few aspects, continuously puzzling case. In absolute terms, the country's fossil fuel and hydropower resources rank with—or even above—those of the United States and the Soviet Union. Globally, China has risen to the fourth place in primary energy production (following the United States, the Soviet Union and Saudi Arabia) and to the third place in consumption (behind the two superpowers) and, in the process, has become not only self-sufficient but also a minor fuel exporter. And yet, at the same time, China's energetics is definitely that of a rather poor, developing country where large segments of rural population still depend on plant fuel and animate power and whose per capita modern energy consumption ranks close to the hundredth place in the global array of some 175 countries and territories.

The future seems no less ambiguous. While the probabilities for retaining the energy self-sufficiency and expanding the crude oil and coal exports are very high throughout the 1980's, the potential fuel and electricity requirements for the modernization of the Chinese economy are immense and its seems quite improbable that they could be filled satisfactorily with the sole reliance on domestic technology. And even under circumstances favoring a very fast expansion, the country's per capita energy consumption by the year 2000 would equal the levels attained by most of the Western societies already during the first two or three decades of this century. . . .

. . . most of China's rural population continues to live as do hundreds of millions of other poor peasants around the world—in solar-dominated ecosystems, largely independent on external subsidies. Even for the nation as a whole solar energy recently transformed by green plants still predominates: approximately 4.1 × 10 kcal of phytomass energy—as food, feed, fuel and raw material—were used to support China's people and animals in 1974, while the total flow of fossil fuels and primary electricity amounted to less than 2.65 × 10 kcal . . . .

. . . Perhaps the best current interpretation of the Chinese coal resource figures is that the recoverable reserves are no less than 100 [billion Metric tons] bmt and the total resources are at least 1,500 bmt. . . .

. . . Quality of coal is mostly very good and seams are of above average thickness and are predominantly horizontal or only slightly inclined. In sum, China's coal resources are outstanding both in their quantity and quality . . . .

. . . Leaving aside the sizeable shale oil resources, whose oil content and recoverability are largely unknown, the best currently available geological evidence, compatible with production totals and growth rates, would indicate that China's crude oil reserves are certainly no less than 3 bmt and most likely no more than 10 bmt. . . .

. . . It is to the Northwest—remote, severely inhospitable, thinly populated (less than 7 percent of the total), unindustrialized (less than 5 percent of gross industrial output) and still only tenuously linked to the rest of the country—where the Chinese will have to turn for their future fuel needs, a westward shift of energy centers comparable in its magnitude to the eastward shift of the Soviet energetics: Northwest has no less than half of China's ultimate coal resources and nearly half of her estimated recoverable onshore oil supplies. The only major way to postpone this costly and complicated shift would be to turn offshore first and to plunge into certainly no less expensive and difficult search and production of underseas hydrocarbons. . . .

. . . China's primary energy consumption, which was barely over 20 [million metric tons conventional energy] mmtce in 1949, grew nearly tenfold in a decade, topped, after years of politically induced stagnation, 300 mmtce in 1972 and is now exceeding 500 mmtce. In aggregate terms, China has thus become the world's third largest energy consumer, just ahead of Japan—and very far behind the Soviet Union and the United States. Per capita consumption, naturally, remains rather low: at around 500 kgce annually it is more than double of India's modern energy usage, but less than half of Mexico's figure—and an order of magnitude less than the consumption of developed nations; addition of the still important traditional fuels increases the aggregate value to some 500 mmtce in 1976 and the annual per capita usage to nearly 650 kgce. . . .

. . . The most striking feature of the Chinese sectoral energy use is the large share of the industrial consumption; even with power generation requirements classified separately, industry now draws about half of all China's primary energy, a sharp increase in comparison with the early 1959's. On the other hand, relative importance of residential and commercial uses has declined considerably since the late 1950's and, significantly, both the power generation and transportation shares, in spite of large absolute increases, have also diminished. Agriculture consumed about 46 times more commercial energy in 1976 than it did at the end of the First Five-Year Plan two decades ago—but in relative terms it is still no more than about six percent. . . .

. . . Expansion of the Chinese primary energy production by seven percent per year for another decade would have to be then termed a success; it would bring the output to just over 600 mmtce in 1980 to some 850 mmtce in 1985, meeting the likely domestic requirements and leaving a small, though valuable, export surplus equal, in crude oil terms, to some 40 mmt in 1980 and 60 mmt in 1985. . . .

. . . Coal industry is to double its output in the next ten years; this means an average exponential growth rate of seven percent per year and the total output in excess of one billion tons of raw coal in 1988. However, as both the Soviet Union and the United States have been finding out, the cost, the environmental problems and the logistics of producing more than half billion tons of coal annually is sharply curtailing any fast growth rates. . . .

. . . Crude oil production will have to be expanded considerably—but exponential growth of no more than ten percent per year would exhaust the Chinese onshore reserves of around five bmt by the mid-1990's. Chinese are, of course, well aware of this fact, as exemplified by Hua's call to discover ten more Ta-ch'ings; even should the required reserves be in the ground, the Chinese investment to discover and to develop them might be of the same order of magnitude as the Soviet oil industry's expenditures during the past twenty years. . . .

. . . Chinese planners also face difficult decisions regarding the future state of small-scale technologies which have played such a critical part in the rural industrialization. Their low quality output and inordinate energy cost do not make them very suitable in more advanced stages of modernization—but their total, or near total, substitution by centralized large-scale production would not be an appropriate solution in a capital-short country so badly equipped with good roads and railways. . . .

. . . In sum, China's energy development strategy should be multifaceted and flexible. Taking into account the richness, location and quality of resources, ancient traditions of solar energetics and enormous regional disparities within the nation, it should strive to modernize the country-side without cutting it completely off its traditional renewable energies and without abandoning appropriate small-scale industries; it should aim for sustainable growth rates of coal and hydrocarbon production by, among others, tapping the still sizeable economics of scale and introducing as many advanced foreign technologies as practicable; and it should attempt to improve conversion efficiencies and encourage proper final uses and widespread conservation. . . . [Smil, pp. 324, 332, 345, 347, 351–354, and 361–364.]

Question 8. What are the likely ranges of population growth and how can Chinese policy control demographic growth?

Almost 30 years have elapsed since Mao Tse-tung declared that China's large population was "a good thing" and that it could multiply "many times" without posing any difficulties for national development. Now birth control has been written into the constitution of the PRC, and Hua Kuo-feng has called for a reduction of the national population growth rate to less than 1 percent within 3 years. . . .

Absolute population totals for the three models as of January 1 and July 1 for the years 1953–80 and every fifth year to the end of the century are given in table 1. Perhaps the most striking implication of these figures is that China's population is close or may already have surpassed the 1 billion mark. The low model reaches 1 billion in 1980, the high model exceeds that figure by 1977, and the intermediate model crosses the line by the beginning of May 1978. The total of 900 million, now at least authorized for domestic use in China, should have been passed at least by the middle of 1974 and possibly as early as the end of 1971.

By the end of the century, the new models show a population of from 1¼ to 1½ billion people. The projections from 1978 onward assume no major catastrophies or other startling changes in fertility or mortality. Up to now, China's demographic determinants have not shown such a high degree of stability. There have been setbacks from time to time in the efforts to control both fertility and mortality which have been significant enough to affect national levels. There is no reason to suppose, as has often been mistakenly supposed in the past, that the course of Chinese history hereafter will be all smooth sailing. The projections of population growth during the remainder of the century are therefore not predictions but simply the implications of some rather artificial assumptions. They serve mainly to indicate the orders of magnitude that would be generated given hypothetical trends in fertility and mortality. . . .

If China's demographic prospects fall within the range indicated by the low and high model projections presented here, it is obvious that there are significant differences between the two extremes by the year 2000. The size of the totals varies by about 17 percent of the mean value and the annual population growth rates range from 1.1 percent to 1.7 percent. However, either of these rates is sufficient to give continuing cause for concern in a country with finite resources at an early stage of economic development with an already large population. The pressure of population growth on the growth of food production may not be greatly reduced by the anticipated decline in natural increase rates if the expedients used to increase agricultural output yield diminishing returns. Unless the economy is more immune in the future than it has been in the past to political dislocations, population growth will continue to dissipate a significant portion of the gains from economic growth. The difficulties of funding productive employment for large increments to the labor force while mechanizing labor in both the nonagricultural and agricultural sectors will continue without much relief from demographic changes before 1990. Hence even the rather spectacular shifts in fertility projected for these models during the next few years do not portend an immediate and radical remission in the problems that have hitherto been posed by population growth in the PRC. [Aird, pp. 440, 465–466, and 474.]

Question 9. How may current regime policies affect the efficiency of the Chinese urban and rural labor force in the years ahead through technological change, modernization and education?

When we try to assess the changes in China it may always be useful to maintain a historical perspective as all changes may not be permanent and we can expect that China will experience political struggle between opposing views on the roles of science and technology and how the sector should be controlled and organized. Is there any risk that China will eventually move toward political changes such as have taken place in the Soviet Union and which the Chinese term revisionism? No doubt, the heavy emphasis on economic growth and the use of the intellectual and technological expertise in the country may make it difficult to strike a stable balance.

The new technology and science policy now emerging in China may be an element which is at least partly antagonistic to the objective of reaching the socialist society conceived by Mao and the reasons for this are several: First, to meet the technology requirements of the modern industry the emphasis must be on large systems with a high degree of vertical division of labor with apparent nonegalitarian consequences for management in production enterprises as well as in the related R. & D. institutions. Second, trend toward further professionalism and inequality encourages importation of technology where technological and management solutions developed in capitalist countries must be adjusted to suit Chinese conditions. Third, if this were desired, the integration and coordination of large scale technological projects and the subsequent applications in manufacturing will require professional expertise which must be highly trained and competent. All such people will spend much of their time in central agencies, ministries or offices in the bigger cities with little or at least less time than previously to move into manual labor. Fourth a large scale approach to industrialization also requires improved transportation and communications and new management systems which all lend some credibility to the argument that new forms of social control might develop which are detrimental to the egalitarian interests of the masses of the Chinese populations. . . .

So, it might be appropriate to pose the following question. The emphasis is on urban technological change—will it be possible for the Chinese leadership to maintain a fair balance between urban industry and rural agriculture? Herein we can find three different type problems with regard to changes in technology and science policy. First will the leadership be able to maintain the delicate but necessary balance in meeting the modernization objectives while reflecting the legitimate interests of the various groups in the Chinese society? Second, as the potentially privileged groups will make use of the new situation to further their own interests, in ways detrimental to the majority of the population in the rural areas will this nonprivileged majority create a counterforce in order to redress the balance? Should this be the case the present change in technology policy would create an unstable situation. Third, will the changes create a situation where privileged groups become established as a stable new class to the detriment of the overall, long-term development of China?

It must also be emphasized that the current situation in China is rapidly changing and the structure for encouraging innovations and change in technology and science policy has not been fully worked out. . . . The current debate on science and technology, as reflected in the news media over the past couple of years, can thus only shed limited light on the future development of science and technology in China. [Sigurdson, pp. 533–534.]

Question 10. What special role does the female labor force play in the Chinese rural economy?

Policies toward women in China are one aspect of the overall attempt to transform the whole country. Every change in general policy has engendered a concomitant change in policy on women. After 1949 the policies that were developed for development in urban and rural areas showed marked differences. The differences were most clear cut in policy statements on employment of traditionally marginal groups in the labor force, such as the young, the old, and women. In contrast to employment of women in urban areas, at no time were women in rural areas officially encouraged to refrain from taking part in production. In rural areas, as policy on the employment of women developed in the early 1950's, women were urged to take part in agricultural production, and increase the number of days they did farm work. . . .

In contrast to the agricultural male population, women of poor peasant origin from the beginning played a crucial role in production teams, as compared to men of the same origin because they were the most skilled of their sex in farm work, since poverty forced them to do farm work from childhood on and often in low and despised jobs such as collecting manure.

Among the women they were usually the most politically reliable as well as the most experienced in farming. In the male population, however, though the poor peasant might be politically most trustworthy he usually was not the most knowledgeable. . . .

The continued insistence that equal pay for equal work must be enforced in the rural people's communes indicates that this principle is not yet universally applied in the Chinese countryside. In perspective, 29 years is probably too short a period to produce a general belief among Chinese that women are the equal of men, when ideas to the contrary have dominated China for more than 2,000 years. [Thorborg, pp. 536–537 and 554.]

Question 11. Will agricultural production trends be raised and cycles of output dampened as a result of current policy and practice?

In the near future there will probably be a sharp increase in grain production as the imported fertilizer plants come on stream and their output stabilizes at designed levels. In mid-1977 six of the plants were reported operating, but probably only one or two were producing at the designed capacity. Five or six more should be in operation this year. A return to normal or better weather is another factor that is likely to cause production to jump in the next year or two. For the past 2 years, even though poor weather has constrained production, overall improvements to the agricultural system, such as irrigation, drainage, and land leveling, have continued . . . .

China's grain production plan for the medium term is extremely ambitious. The Government's output target for 1985 is 400 million tons, compared with 285 million tons in 1977 . . . .

Realistically, the Chinese are likely to fall somewhat short of the 1985 goal. A great and successful effort to achieve rapid growth in the medium term could nonetheless raise total and per capita output well above past levels. If the population growth rate continues to be kept under control, the Chinese might be willing to accept somewhat slower rates of growth in agriculture. Success in securing higher levels of agricultural production would assure the maintenance of at least subsistence consumption whatever the weather, and would help free the rest of the economy from the vicissitudes of the agricultural sector . . . .

In the longer term, as yields increase they may well eventually approach the levels that most more advanced countries enjoy today. Rice yields in China now average 3.5 tons per hectare of sown area; if they increased by 50 percent they would slightly surpass the 1975 rice yields of the United States and Greece, for example, although they would fall short of the 1974 yields of Italy, South Korea, and Spain, and well short of recent Japenese yields. In terms of rice yields, China is now in about the same position that South Korea and Taiwan reached in the early and mid-1960's, and that Japan reached earlier in this century . . . . With increasing modernization, Chinese yields are likely to move through the levels that Japan reached in the years following World War II, and that South Korea has achieved since the mid-1960's. [Groen and Kilpatrick, pp. 645–646.]

Question 12. Is the PRC of permanent and expanding importance in the world grain market? What type of grain and with which producing countries will the PRC likely trade?

The pattern of grain trade of the People's Republic of China (PRC) shifted abruptly in 1961 when China began a large grain import program. Although the PRC has continued to export rice, it has remained a net importer of grain despite slowly rising per capita grain production. During the 1970's, the annual variability of China's grain trade has increased considerably.

Grain imports have become less important in comparison with national grain production, but continue to provide an important part of grain supplies in the urban areas of northern China, as well as adding significantly to the total supply of wheat, a preferred food-grain. During the 1970's, grain imports have followed fluctuations in per capita production of grains, suggesting that imports have been closely tied to state grain procurement from rural areas in northern China.

China's rice exports have covered a substantial part of the costs of grain imports and the net cost of grain imports has fluctuated far less than the quantity of imports. The level of rice exports appears to be correlated with the cost of the grain import program and to a lesser extent with the level of per capita rice production. But available information does not provide a full explanation of the determinants of rice exports.

A survey of factors affecting grain import levels suggest that the growth of domestic demand for grains will increase in the future. Increased domestic feed-grain demand for urban livestock raising is also likely. PRC policy appears to favor self-sufficiency in grains, and imports of industrial goods and technology seem to have the highest priority in coming years. Therefore unless China is successful in increasing the growth rate of grain production and state procurements, pressures will build for higher grain import levels and other economic policy goals will be compromised.

The United States appears at present to be a residual supplier of grain and other agricultural products to the PRC. Until this changes, United States grain exports to China are likely to remain highly variable and substantial on an ongoing basis only if the PRC is unsuccessful in holding down grain import levels. [Surls, pp. 653–654.]

Question 13. What are China's technological options for improving agricultural performance?

A common strategic objective underlies the entire program of technological change in Chinese agriculture, specifically the increase in the extent of multiple cropping. In comparable environmental circumstances, where other countries are growing a single crop per year, China seeks two; where others grow two, China seeks three. The impact of this goal on the forms and direction of technological change in Chinese agriculture cannot be exaggerated:

Multiple-cropping dictates extreme earliness as an overriding objective of Chinese seed breeding, at a cost of potential yields and ease of borrowing from foreign breeding programs. Multiple-cropping makes an available supply of organic and chemical fertilizers, which is now becoming adequate by the standards of a modern, single-cropping system, inadequate to satisfy requirements of two or three crops, so that one or no crops can reach optimal yields. It also necessitates the absorption for the foreseeable future of large quantities of labor in low-productivity collection and processing of organic fertilizers, exacerbating the labor-productivity gap between agriculture and industry. Multiple-cropping increases the water requirement in Chinese agriculture, forcing further development of artificial irrigation in areas where rainfall or existing irrigation systems are adequate for only one or two crops, at a significant cost in capital, labor and land encroached on by the irrigation systems. Multiple-cropping creates the bottlenecks in labor and draft animal supply which make mechanization a prerequisite for further intensification, rather than a means of sustaining farm production with a decreased labor force as in other countries. It also forces the continued maintenance of a huge draft animal stock, which reduces grain available for human consumption or meat production. Multiple-cropping, through its requirement of earliness, creates the need for dense planting, whereas other countries have tended to reduce labor and seed production requirements through sparser planting with no loss in yields.

In view of the severe cost of increasing the multiple-cropping rate, one would hope that the benefits clearly outweighted those of alternative strategies. Unfortunately, I have seen no evidence that the Chinese have considered any alternatives at least since the 1950's, even though changing technologies may have made earlier appraisals of limited relevance. By now, the efficacy of multiple-cropping has become a matter of doctrine, at least at the official level.

The most plausible alternative would not have been single cropping, except in the north, but rather a maintenance of the *status quo ante,* a system of double-cropping south of the Yangtse River (rice-rice in the warmer areas, winter wheat-rice otherwise), and intensification of production within that constraint. Based on the experience of other countries and the costs and difficulties experienced in changing this system in China, this would have been the "natural" course of development, in the absence of forceful state intervention . . . .

Chairman Hua Kuo-feng has been more intimately involved in the promotion of technological change in Chinese agriculture than any other high level leader except Chen Yung-kuei, and this involvement has encompassed the failures of the Great Leap technological policies as well as successes in irrigation and seed development work in recent years, yet his optimism about further potential is as striking as the 4–5 percent growth target he recently announced . . . .

As this incomplete summary should suggest, China's program for attaining its targeted growth rates is comprehensive and technically (and probably economically) sound; it responds simultaneously to the problem of accelerating the growth of the laggard regions and crops and that of enlarging potential at the technological frontiers. In its ambition and breadth of mobilization it is comparable to the Great Leap, but, as with the more narrowly-based programs of the last fifteen years, the potential sources of growth have been correctly identified and are not illusory. The open question, then, is not whether the program as stated is sufficient to meet the targets (even if we cannot quantify the potential contribution of each element of the program). Rather, it is whether China can mobilize and organize the resources to carry it out. [Wiens, pp. 700 and 702–703.]

Question 14. Is the current regime's interest in foreign economic relations likely to expand and stabilize? What are the specific prospects of Sino-American trade?

China's foreign trade, although a small component of gross national product, plays an important role in sustaining and modernizing the Chinese economy. A relatively small trade sector, of course, is expected of a vast and populous country such as China,which has extensive domestic resources and a huge domestic market. Yet, the share of trade in China's GNP, only about 5 percent, is low by world standards reflecting the residual role assigned trade in the centrally planned economy and the conservative attitudes toward trade as a result of historical and more recent experiences.

Trade is the balancing sector in the planning process with imports making up for the shortfalls in domestic production and providing goods that cannot be produced in sufficient quantity, or at all, in China. Exports are not viewed as an end in themselves but as a means to pay for imports. Moreover, trade and financial policy has been very cautious, colored by Peking's view of the unhappy experiences with trade in both pre-1949 China and the period of Soviet cooperation in the 1950's. Self-reliance has been the guiding principle although its interpretation has been the subject of some debate in China over the years . . . .

While exports will be the determining factors, imports will be the *raison d'etre* for China's trade expansion in the future. Purchases of foreign plant and equipment will be a major component of China's economic modernization drive, industrial supplies will help sustain the growth in industrial production, and agricultural imports will compensate for shortfalls in the farm sector. Because imports will be tailored largely to export growth, they will likely grow at roughly the same rate over the eight year period . . . . [Batsavage and Davie, pp. 707–708 and 728.]

Two central themes run consistently through the foreign trade policy of China. These are "self-reliance" and "trade on the basis of equality and mutual benefit." In self-reliance, Peking perserves independence by reducing reliance on foreign assistance and by limiting the foreign presence in China. . . . In equality of trade, Peking sees a way to supplement China's own resources without risk of entanglement while creating a useful channel for promoting understanding of China's socialism and other diplomatic objectives . . . . On the basis of these policies, China is now trading with over 150 countries and has entered into trade agreements with more more than 50 countries . . . .

China is now embarked on a massive program to modernize agriculture, industry, science and technology, and national defense in a way designed to propel the PRC into the front ranks of industrialized nations of the world by the turn of the century. To achieve these goals, substantial quantities of complete plants and related technology will have to be imported. But in the past these types of imports have caused ideological problems in the Peking leadership. . . . By 1973 it was safe for one leading trade official to link technological imports with self-reliance . . . .

The reality of that policy is seen in the purchase by China during the period 1972–1975 of some $2.7 billion in complete plant and associated technology.

After that period, policy shifted again, and brought a virtual halt to the import of complete plants which lasted until the arrest of the Gang of Four in October 1976. Since their ouster, the Hu Kua-feng leadership has stressed the importance of foreign trade in growth of Chinese economic development. Retrenchment of the economy during 1977 prevented as quick a return to large scale plant and technology imports as had been expected in the West. Contracts will be negotiated in 1978, but most new plants will contribute to the modernization program until after 1980. The pace of such purchases will depend on China's ability to expand exports, especially oil, and on China's need for foreign agricultural products. Peking's willingness to increase the use of credit will also affect the pace. [Clarke and Avery, pp. 748–749.]

Question 15. With increased modernization will the PRC be more willing to accept the normal legal practices of the world market?

. . . Although it remains highly unlikely that the Western legal tradition, which had taken hold in China before 1949, will exert a discernibly strong influence, pragmatism and the need to develop solutions to the problems of managing an increasingly more complex economy may impel Chinese planners to choose selectively from analogies derived from the experience of other nations, developed as well as developing.

It is too early to be confident that a lasting commitment has been made to fashioning and using institutions for implementing policies that decrease the means of mass mobilization and increase the making and application of rules by officials charged with those tasks. Even if policy could change again, though, the present mood and current experimentation reflect an openness and flexibility that are striking by contrast to the policies that dominated the previous decade. [Lubman, pp. 765–766.]

Question 16. What are the PRC prospects for expanding exports to the industrial West to gain hard or convertible currency needed to finance imports?

This paper provides data covering recent exports of the People's Republic of China to twenty hard currency countries. This group of twenty includes all the major industrialized Western countries plus a few countries in Asia, which by virtue of geographic proximity are significant export markets for the PRC. . . .

At $5 billion, 1976 exports to The Twenty countries were about 140 percent greater than the 1972 level.

At nearly $3 billion, China's exports of primary products (SITC 0–4) accounted for 58 percent of the total and were the largest group of commodities exported to The Twenty countries in 1976. Nearly one-half of these exports were food and live animal items (STIC 0). . . .

China's hard currency export capabilities are relatively diversified, with the top fifty items accounting for only 64 percent of trade. There was, however, a relatively large concentration of exports among the top ten items, which comprised one-third of total hard currency earnings from The Twenty. After the top ten, all the remaining items in the top fifty ranking individually contributed on the average of one percent to total hard currency earnings.

The commodity composition of the top fifty items exported to the twenty varied only slightly over the three years between 1974 and 1976. In 1974, 63.1 percent of total hard currency was earned by the top fifty; in 1976, this percentage had risen slightly to 63.6 percent. . . .

. . . textile fabrics (SITC 65) contributed the largest share to hard currency earnings in 1976. . . .

Petroleum and petroleum products (SITC 33) ranked as the second largest hard currency export earner in both 1976 and 1974, and the largest in 1975. . . .

Among food items, the most important have been swine, rice, and seafood (SITC 0013, 0422, and 0313).

The most important manufactured item exported by the PRC was basketwork (SITC 89922), followed by a wide variety of clothing items. Besides basketwork and clothing, the remaining manufactured item appearing on the top fifty was footwear (SITC 85102). (Kravalis, pp. 790, 793, and 794–795.)

Question 17. If Most-Favored-Nation (MFN) tariff privileges were extended to the PRC how might this development affect trade turnover in Sino-American trade?

This paper presents estimates of the amounts by which U.S. imports from the PRC would have exceeded their actual 1976 values had PRC products been assessed at U.S. Most-Favored-Nation (MFN) tariff rates in that year. Our estimates are derived from a detailed econometric analysis of the tariff sensitivity of China's top fifty 1976 hard-currency-earning exports, on a product by product basis. Because we do not expect that the product composition of China's overall hard currency export capabilities will alter rapidly in the near term, we believe that the 30 percent MFN-induced rise in total U.S. imports from the PRC predicted by this model may be taken as applicable to the near future, should the United States grant MFN to China during the next few years. [Raffel, Teal, and McQueen, p. 840.]

There is another assessment on the potential impact of extending MFN.

The following restates the principal conclusions of this study:

—The price elasticity of U.S. import demand for many of the types of products exported by the PRC is relatively low. Therefore, small changes in prices of these imported goods are likely to produce only limited consumer responses.

—A significant proportion of current PRC exports to the U.S. are subject to ad valorem tariff differentials. Some are assessed only specific duties, and the impact of MFN extension for these commodities would be small.

—Given the price inelasticity and number of products not subject to ad valorem tariff differentials, the impact of MFN extension on those products currently being traded would be limited—perhaps five to seven percent of the actual import level.

—Lack of MFN appears to have a substantial impact on certain commodities exported by the PRC, principally light manufactures. These commodities are imported by the U.S., but at disproportionately low levels compared to the EC market. If U.S. imports of PRC products had been "normalized" (i.e., equivalent to EC imports), the impact of MFN extension in 1975 at the normalized level would have been about 55 percent of the actual level of trade. In 1975, the difference between the normalized import level and the actual level for commodities with ad valorem differentials was approximately 90 percent of total imports. This suggests that the MFN impact in that year would have been between 50 and 90 percent of the actual value of imports.

—In the future, the ratio of actual imports to "normalize imports (however defined) can be expected to rise; eventually a plateau may be reached. As trade increases, the significance of the lack of MFN should also increase, both in absolute value terms and as a percentage of the shortfall between actual and "normalized" trade.

—The effect of MFN extension on U.S. domestic employment is likely to be small—fewer than 6,000 workers under the most pessimistic estimates. The apparel and light manufacturers (toys, sports goods, etc.) industries would be most affected. [Kilpatrick and Lincoln, pp. 827–828.]

Question 18. What special economic relations does the PRC have with the developing world? As a recipient of aid from the PRC and the USSR, how does the Albanian case illustrate the comparative effectiveness of Chinese aid?

Political turbulence in the People's Republic of China and the slowdown in domestic economic growth led to a decline in economic aid pledges to the Third World in 1975–77, to less than $200 million a year from the $500 million annual commitments of the first five years of the decade.

Aid disbursements, on the other hand, maintained a brisk pace at $220 million a year in 1975–77, as earlier commitments were carried out and as new countries were added to the list of recipients.

The number of Chinese technicians in the Third World rose to an all-time high of 24,000 in 1977.

China gets good marks for its economic aid program, which emphasizes small-scale development programs and tailors projects to the needs and resources of its Third World clients.

Chinese-LDC trade has become an important source of hard currency for China, at the same time providing new markets for Third World raw materials.

Military transfers, which are concentrated overwhelmingly in Pakistan, have been a small fraction of the Chinese aid program and are dwindling in the face of Soviet and Western competition. [Fogarty, p. 851.]

A study of the Albanian experience also suggests that a theory of aid which does not take account of ideological and political factors can never fully explain the impact of aid on a centrally-planned developing economy. The Albanian split with the Soviet Union provides the most dramatic illustration of this point.

> From a practical point of view, it seems reasonable to conclude that, while Albania has been able to maintain a reasonably steady flow of external credit throughout the past thirty years, the aid has nonetheless acted as a constraint on Albanian industrial policy in two important aspects. First, the aid received from Comecon assisted the development of light industry in Albania at the expense of heavy industry, notwithstanding the implied benefits for Albanian exports. It also operated to the detriment of agriculture up to 1953, but this appears to have been a failure of PLA policy rather than a constraint imposed by donor motivation. Second, the aid provided by China seems to have been fully in accord with a Stalinist strategy, but the geographic problems involved in commodity transport between China and Albania and China's instability as an aid donor may account for Albanian difficulties in completing the construction of industrial projects within a planned time. [Schnytzer, pp. 878–879.]

PROSPECTS AND PROBLEMS

This volume on the economy of the People's Republic of China may be especially timely for American policymakers, scholars and the general public for several reasons:

1. The post-Mao leadership has given high priority to economic modernization, professionalism, and incentive systems in planning and management. The need of PRC's economy for Western products and processes have created an opening for greater influence and a favorable environment for closer commercial ties between China and Japan, the United States and other Western industrial economies.
2. The rapproachement between the United States and the People's Republic of China has been followed by increasing political, commercial, scientific, social and other relations. Commercial relations have expanded due to China's stated needs for Western technology—including modern fertilizer plants to increase agricultural output. Expanding oil revenues and a more flexible attitude toward credit and other aspects of the Western market suggest wider future commercial ties. Since our continuing ties with Taiwan and concerns on arms control are serious barriers to rapid improvement in political and military relations, for the immediate future improved economic intercourse may be the most attractive avenue for improving Sino-American relations.
3. The leaders of the PRC have given priority to economic modernization. Although purchases of foreign military technology and an expressed need for military industries modernization is part of the current long run policy Western influence is still likely to be greatest in relations to China's economic needs. In spite of possible progress on birth control, the Malthusian spector still looms in China's future. Imports of grain and transfer of agricultural technology from the West, may be the critical long-term ingredient, although marginally significant in the short run.
4. Modest, but significant, improvements in the quantity and accuracy in published economic data, empirical evidence from exchanges, substantially increased Western access to the end users of the imports, have aided the Western analyst in appraising China's economic policy and performance.

It is difficult to separate elements of long-term trends from cyclical or variable factors in performance. However, it seems clear after over a quarter of a century of power that Chinese leaders aim to develop a modern, powerful, industrial state which would be capable of dealing on equal terms with superpowers and at the same time, providing adequately for its citizens' needs. The current Chinese development plans, however, do not include the Stalinist type urgency to overtake and surpass the West in a short, definite time period—a goal the Chinese expressed during the Great Leap period.

Against this long-term aim of achieving an economic basis for superpower status, there appear to be political, ideological, and social policies which from time to time override the short-term progress of economic nation-building. Some of them may take on importance in the years immediately ahead and influence economic performance:

> *Political succession.*—Inevitably, Hua and Teng, the successors to Chairman Mao and Chou En-lai will be challenged. Successions elsewhere, for example, after Lenin and Stalin, suggest that an unforeseen, unsettling struggle is more likely than orderly transfers of power.
>
> *Ideological revitalization.*—There have been times such as the Great Leap and Cultural Revolution periods when the requirement for ideological revitalization conflicted with policies for economic performance. If this experience is repeated periodically, stable long-term growth prospects may be in jeopardy. To assume that no recurrence of these economically disturbing political-ideological cycles is, on the one hand, to give very great weight to the unique force of Mao's personality and on the other hand, to deemphasize the broader base of support for the "Yenan" revolutionary spirit in the Party and nation as a whole, which Mao must have had.
>
> *Foreign threats or opportunities requiring more weapons and military forces.*—Concern with the Soviet Union may at any time lead to a major shift in Chinese weapons or force buildup. Also, despite present indications of military restraint, under different circumstances Peking might well become more actively involved in supporting Asian Communist powers.

Indeed, some would argue that these political factors represent central, fundamental forces in Chinese society and that economic considerations are the external or variable factors. Whatever the primary and secondary forces may be in Chinese development, it has become clearer in each successive economic assessment that the PRC economy has attained a firmer base for claims of meeting not only domestic but the major international goals of the leadership. In spite of many current and likely future problems, we should not assume that the People's Republic of China will not be able to continue to meet its priority economic needs.

Part I. POLICY PERSPECTIVES

CHINA'S POST-MAO ECONOMIC FUTURE

By Robert F. Dernberger and David Fasenfest*

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A unique feature of China's emergence as a major world power has been the continued dominance of a relatively small leadership group whose members had gained prominence in the Chinese Communist movement during the 1920's and 1930's. The resulting control over policy formulation and implementation over such a long period by this relatively small group of leaders, their advancing age—most were born in the 19th century—and their failure to groom and share power with a younger generation of leaders, led many Western political analysists to contemplate and offer predictions on the outcome of the inevitable succession crises.[1] Actual developments in the mid-1970's dramatically set the stage for the succession crises with the death of the three most eminent leaders of the Chinese Communist Revolution—Mao Tse-tung, Chu Teh, and Chou En-lai—in a single year.

Events over the year and half between the death of Mao (September 1976) and the convening of the Fifth National People's Congress (February 1978) have been both dramatic and unexpected. The attempt of the radical left leaders, who had acquired positions of power during the Cultural Revolution in the mid-1960's, to seize complete control was quickly thwarted by the arrest of "the Gang of Four" [2] and the widespread campaign to expose and remove their followers at all levels of the political system. The advocates of a more moderate or pragmatic approach to the Socialist transformation of China's economy and society, on the other hand, have now been rehabilitated and restored to power. The speeches made, the resolutions adopted, and the officials elected at the Fifth National People's Congress all symbolize the extent to which the moderate or pragmatic wing of the Party has emerged victorious in the present stage of the succession crises.[3]

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[1] See, for example, Richard Wich, "The Tenth Party Congress: The Power Structure and The Succession Question," China Quarterly, No. 58, April-June 1974, pp. 231–248.

[2] The "Gang of Four" is the designation given to the four major leaders of the radical left at the time of Mao's death: Yao Wen-yuan (Shanghai propagondist who gained prominence during the Cultural Revolution and became an editor of "Red Flag," the Party's official journal), Wang Hung-wen (also from Shanghai, leaped into prominence at the 10th Party Congress in 1973 and later became No. 2 in the Party heirarchy behind Hua Kuo-feng), Chiang Ching (Mao's wife, probably most militant of the Gang), and Chang Chun-chiao (from Shanghai, Deputy Prime Minister to Chou En-lai, probably less partisan, but more politically potent than rest of gang).

The influence of the radical left in China, of course, is not eliminated by the arrest of the "Gang of Four", nor by the restoration of the moderates-pragmatists to high-level positions of power. The repeated campaigns of the radical left in the past to transform Chinese society according to the thoughts of Mao have obviously left their stamp on the values and behavior of a generation of Chinese. Moreover, although the extent of the vicory of the moderates-pragmatists is quite surprising, the real winner in the present stage of the succession crises is Hua Kuo-feng. Not only was Hua a relatively unkown only a few short years ago, he also cannot be readily identified as a member of the moderate-pragmatic leadership faction.

His reputation as a provincial-level problem-solver in the agricultural sector and his loyalty to Mao undoubtedly led to his being selected as the Chairman of the national conference on the Ta-chai type advanced county campaign for the modernization of China's agriculture, held in the fall of 1975. Shortly thereafter, and before Mao's death, he was surprisingly elevated to the very apex of the political system, presumably to serve as a caretaker to supervise the succession crises which would follow Mao's imminate and anticipated death. Hua's sudden and unexpected appointment to this critical position of power may be partially explained by his lack of a national reputation, his lack of an independent power base, and his not being a well-known advocate for either of the groups who would be contending for power in the succession crises. The recent reaffirmation of his position as chairman of the party by the 11th National Congress of the Chinese Communist Party and as chairman of the Government by the Fifth National People's Congress is interpreted by some observers as a sign of the continued instability in the current alinements and balance of power within the leadership. On the other hand, the evidence also suggests that he has not only survived the succession crises, but is emerging as a major new force in China's political leadership, representing a synthesis of the dialectic conflict between the two line struggle of radicalism and moderate-pragmatism in the formulation of China's economic policy over the past three decades

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[3] Although the terms used in this paragraph and throughout the remainder of the paper to identify the leadership groupings engaged in the "2-line struggle" for control of China's economic development policy are somewhat inprecise for the purpose of identifying particular individuals or economic policies, these terms are meaningful labels for the purpose of distinguishing between two major catagories of economic policies which have been advocated for the achievement of China's economic modernization.

On the one hand, the moderate-pragmatic policies give greater priority to economic development as the short-run goal and as a prerequisite for achieving the socialist transformation of China. As a result, they place greater emphasis on the more traditional economic policies associated with efficiency, a rational division of labor, advanced technology and modern industry, and reliance on the skills of technicians and engineers. In other words, the advocates of these policies favor placing economics in command in the short-run and leaving the achievement of the goal of social transformation to the long run. Thus, the major constraint on the moderate-pragmatic policies is their short-run challenge to the ideological goals of Mao's socialist revolution.

The radicals, on the other hand, using the Soviet experiences as an example, realize that the moderate-pragmatic economic policies may well involve the creation and entrenchment is Chinese society of social values and behavior that are antagonistic to the objectives of achieving a true socialist society—so much so that this objective is not only postponed but eventually eliminated. Thus, they see the necessity of advocating simultaneous and complementary economic development and social transformation. As a result, their economic policies involve a much greater tradeoff between the objectives of economic development and social transformations than do those of the moderates. The major constraint on the radicals is the reality of Chinese society today: beset by economic problems and, without Mao, an economic, political, and military leadership that is disinclined—because of these economic problems—to accept or support them.

The above policy differences are largely a matter of emphasis or degree, not contradictory alternatives. Nonetheless, the dynamics of political realities over the past three decades in China led to the situation in which these two groups became rivals and were the major contenders for power in the succession crises.

Whatever is true of Hua's own position, the contents of the majority of articles in the Chinese press over the past year, the new appointments to high level positions in both the party and Government over that same period, the essence of the new constitutions of both the party and the Government, and a key passage from Hua's address to the Fifth National People's Congress all attest to the rather dramatic shift in the balance of power within the leadership in favor of the moderate-pragmatic faction, with their first order of business being China's economic development. According to Hua:

> In order to make China a modern, powerful socialist country by the end of the century, we must work and fight hard in the political, economic, cultural, military and diplomatic spheres, but in the final anaysis what is of importance is the rapid development of our socialist economy.[4]

In its details, however, Hua's speech to the Fifth National People's Congress does not indicate the moderate or pragmatic point of view has had a significant impact on the program he presents for achieving the rapid development of China's economy. It is, of course, necessary to recognize Hua's speech as fundamentally a policy statement with a major political objective; an appeal to the Chinese to rally behind the new leadership in their attempts to achieve the economic modernization of China. Furthermore, the specifics of the program adopted by the Fifth National People's Congress to achieve this goal, the long-run economic plan for 1976–1985, were presented by other speakers to the Congress and have not been published. We are told, however, that this plan is the same as the plan which had been drawn up in 1975, that is, before Mao's death, the arrest of the "Gang of Four", and the restoration to power of the moderate-pragmatic leadership. Nonetheless, the targets of the plan, apparently unrevised in light of developments in the 2 years since they were originally formulated, were formally presented to and adopted by the Congress. Thus, while neither Hua nor the new moderate-pragmatic leadership should be held responsible for the formulation of the economic program summarized in Hua's speech, the emphasis given the plan and its specific targets in the speech, its adoption by the Congress, and the whole discussion of China's economic problems and the policies for the solution of those problems presented by Hua does raise serious questions as to the extent to which the moderates-pragmatists are in control of China's future.

For example, Hua's speech places much of the blame for China's current economic problems on the policies and interference of the "Gang of Four", rather than recognizing them as fundamental, long-run economic problems inherent in China's past economic development and current economic environment. These problems will not be solved merely by the arrest of the Gang of Four and the restoration of the moderate-pragmatists to power.

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[4] Hua Kuo-feng. "Unite and Strive to Build a Modern, Powerful Socialist Country!" Report on the Work of the Government Delivered at the Fifth National People's Congress, Feb. 26, 1978, in "Peking Review," No. 10, Mar. 30, 1978, p. 18.

Secondly, the summary targets for 1985 emphasized in Hua's speech resemble those used in the past to mobilize labor in a mass campaign to accomplish a great leap, rather than the rational projection of what is feasible in light of the constraints imposed by China's fundamentale economic problems. As mentioned above, these targets for 1985 were drawn up in 1975, but in light of the economic developments in 1976 and 1977, much of what was to be done in 10 years, is now to be accomplished in 7. For example, the target for grain output, 400 million tons, implies a rate of growth in grain output over the next 7 years of 4.8 percent a year and Hua claims that total agricultural output is to increase by between 4 and 5 percent a year. Not only have the Chinese been unable to obtain such rates of growth for any 3-year period in the past three decades, no other major grain producer in the world has been able to maintain rates of growth such as these over a continuous period of 7 years. For steel, the target is 60 million tons, but this implies the import, construction, and placing into production of a major new steel complex at the rate of about one a year for the next 7 years. In the next 7 years as a whole, the rate of industrial investment and production (more than the total of the entire past 28 years) imply a level of imports and industrial labor force such that the exports, transportation facilities, social overhead capital, energy, and middle-level technical personnel requirements would exceed any realistic assessment of Chinese capabilities.[5]

Quite simply, the targets of the plan reported by Hua are those which are derived from the long-run, idealistic goals, held forth by Mao and Chou En-lai over the past 10 years: the overtaking of the most advanced industrial countries by the end of the century. Or, more specifically, the hope to achieve and surpass the world's highest yields in major agricultural crops and the world's highest levels of output for major industrial products by the end of the century. This is an acceptable and meaningful long-run goal. It is not, however, the basis for operational and realistic short-run plans for the allocation of resources in the search of a pragmatic solution to China's immediate economic problems.

The pragmatic solution of these problems requires the Chinese leadership to make hard choices among the alternative allocations of investment for the achievement of alternative objectives. Over the past year, the many nationwide conferences that have been held and discussions in the Chinese press clearly reveal the nature of these choices the new leadership faces in choosing tradeoffs among the various sectors of the economy: consumption versus investment, the military versus civilian sector, agriculture versus industry, heavy industry versus light industry, exports versus domestic consumption, domestic education and research versus imported technology and expertise, et cetera. There are, of course, many alternative choices which must be made within each of these individual sectors as well. Yet, rather than recognize the importance of these choices for China's future economic development and the extent to which some of these choices have already been made, Hua's speech promises something for everyone: higher standards of living (in normal years, 90 percent of the peasants are to receive an increase in income), the modernization of the military, a record-setting pace of agriculture development, an exceptional rate of growth in foreign trade with no mention of borrowing from abroad (there is also no mention of self-sufficiency), an educational and training program which will allow China to overtake the best scientific and technological standards in the west, and so on. These programs are said by Hua to be necessary in order to turn the plan into reality. This is true, but the task of the new moderate-pragmatic leadership is the need to formulate operational economic programs and plans for the long-run achievement of economic modernization for China which are based on the reality of the economic constraints of China's economy, not derived from Mao's slogan that this economic modernization was to be achieved by the end of the century.

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[5] This argument is supported by the findings in several papers in this volume. See, especially, Nai-ruenn Chen, "Self-Reliance versus Learning from Abroad: China's Path to Economic Modernization"; William Clark, "Electric Power Industry"; Jon Segurdson, "Urban-Rural Relationships: Technology and Manpower Policies"; and Hedija Kravalis, "China Export Potential".

Our purpose in this introductory paper is to present an alternative assessment to that contained in Hua's speech: an alternative to his assessment of the fundamental economic problem's faced by the new leadership, an alternative to his projection of the feasible course of China's economic development over the next decade, and an alternative analysis of the economic consequences of the policy choices the new leadership has made concerning the various objectives of economic modernization Hua presents.[6] This alternative discussion of these problems should provide the reader with a meaningful overview of China's contemporary economic evolution and the necessary frame of reference for interpreting and integrating the arguments presented in the individual papers in the following sections of this volume and for evaluating the detailed collection of revised estimates for economic activity in China over the past 28 years to be published in volume II.[7]

Although this paper attempts to provide such a framework for interpreting and evaluating the other papers, it is important to note that no attempt has been made to have the individual authors of the other papers adopt any particular framework of analysis, point of view, or conclusion. For example, the emphasis in this paper is on the long-run trends and relationships in China's economic development and the analysis leads us to conclusions which can be interpreted as somewhat pessimistic. The following paper by Nicholas Lardy, assessing many of the same problems raised in this paper by analyzing the short-run developments within the more recent past, yields conclusions which tend to be much more optimistic. The individual authors of the papers in this volume were chosen on the basis of their expertise in the subject matter they were asked to investigate; not on the basis of their point of view. Thus, different interpretations of China's economic development and policies in both the past and in the future can be found in the papers that follow. That is as it should be. In their campaign to develop their scientific and technical capabilities so as to catch up with the West by the end of this century, the Chinese have adopted Mao's slogan to "allow 100 flowers to bloom, 100 blossoms to contend." That same motto holds true for our search for the truth concerning China's economic evolution in this and the papers that follow.

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[6] Much of the discussion in this paper relies to a great extent on a much more detailed analysis of China's fundamental economic problems, projection of China's economic development over the 1980's, and the choices among the various investment and policy options the new leadership would face written by Robert F. Dernberger and published shortly after Mao's death. See Robert F. Dernberger, "China's Economic Future," Allen S. Whiting and Robert F. Dernberger, "China's Future" (New York: McGraw Hill, 1977).

[7] The remaining papers in part I are also presented to provide a framework for interpreting and integrating the arguments and empirical evidence found in the other papers presented in the following sections of volume I and those in volume II. Whereas this paper emphasizes long-run economic relationships and trends in China's economic development, the following two papers raise many of the same problems discussed in this paper, but analyze them from a somewhat different point of view. Nicholas Lardy, in his paper on "The Economic Options of Hua Kuo-feng," emphasizes economic developments over the past few years and the possible developments in the immediate or near future, that is, the next few years. William Whitson's paper on "Politics and China's Economy" emphasizes the political forces or considerations which have influenced economic policies and developments since Mao's death and which will have an important role in determining those policies and developments in the immediate or near future.

The remaining four papers in part I cover a variety of topics, each of which contributes to a better understanding and interpretations of what follows in volume I and volume II. Alexander Eckstein summarizes the Chinese economic development objectives, strategies, and accomplishments over the past 25 years in their search for economic modernization in "The Chinese Development Model." How Soviet specialists have interpreted and evaluated Chinese economic development policies and performance is surveyed by Leo Orleans in "Soviet Perceptions of China's Economic Development". The extent to which a very significant dependence on foreign technology and trade will be a necessary consequence of the Chinese desire to rapidly achieve economic modernization by the end of this century is indicated in Nai-ruenn Chen's "Self Reliance versus Learning from Abroad: China's Path to Economic Modernization." Finally, a summary review of economic developments and policies during the mid-1970's is presented in Arthur Ashbrook's "China: A Shift of Economic Gears in the Mid-1970's."

PAST PERFORMANCE AND THE ECONOMIC PROBLEMS OF THE MID-1970'S

During a very few years after the Second World War, the Chinese Communists emerged from their guerrilla bases, rapidly seized control of large portions of Manchuria and North China, crossed the Yangtze, swept through the south, and in 1949 announced the creation of their new government for all China—the People's Republic of China. The economy they inherited included over 500 million people who were poorly fed, clothed, and housed and who had a per capita GNP that was probably less than US$50. The economy's productive capacity had suffered severe damage during the Civil War. Moreover, after the Second World War the Russians had dismantled and removed over 50 percent of the industrial capital in China's largest industrial and railroad base, Manchuria. Even in the 1930's, industrial output had accounted for only 10 percent of China's GNP, but in 1949 the absolute level of output in industry fell to only one-half its prewar peak. That same year was little better for agriculture: grain and cotton outputs were, respectively, about 25 and 50 percent lower than the prewar peak levels.

In addition to commodities production being at a very low level, the underdeveloped and partially destroyed transportation system made regional distribution of both goods needed for production and processed goods a serious problem. The rampant inflation that had been underway since 1936 had also seriously distorted business incentives (by leading to speculation, et cetera) and had prevented the rational allocation of resources to meet China's basic needs (rational being the use of resources in their most effective and beneficial way, which by definition can occur only in a noninflationary economy). Moreover, with domestic shortages limiting China's export capacity, the state treasury's holdings of foreign exchange reserves having been removed by Chiang Kai-shek to Taiwan, and the small likelihood of foreign aid and assistance from a hostile Western world, China's capacity for alleviating those shortages by imports was severely limited.

The length and scope of this analysis do not permit a description of how skillfully fiscal and monetary policies were used in the reconstruction program that restored production to its peak levels of the prewar period by 1952. Those enterprises that had been owned by the Nationalist government or by bureaucratic capitalists were taken over by the state, but private enterprise was allowed to remain in operation, as was a market system for the allocation of resources. The state budget was balanced, and revenues were used for investment in the public sector. State trading companies were created to dominate both internal and external trade in key commodities, but rationing was not yet introduced, nor were price controls. Furthermore, this remarkably successful rehabilitation program was carried out with limited Soviet aid while China was fighting the world's largest military power in the Korean war and at the same time carrying out a sweeping redistribution of economic, social, and political power by means of land reform in the countryside.

Between 1949 and 1952, the new government restored price stability, increased industrial output 2.5 fold and agricultural output by 50 percent, brought the balance of payments under control, and more than doubled imports, with producer goods accounting for over 90 percent of the total imports. Most important, GNP per capita, in real terms, in 1952 was 35 percent higher than it was in 1936.[8]

Institutional Reorganization of the Economy[9]

Having successfully consolidated their control over the population and economy and revived production to roughly the levels obtained before the war, the Chinese launched their program of institutional change and economic development to achieve the transformation of China into a modern industrial power. The agricultural sector was reorganized into elementary producers' cooperatives, into advanced cooperatives a few years later, and finally into People's Communes in 1958. The communes were intended to replace the lowest level of government in political administration and were to be the essential decisionmaking and accounting unit in production in the rural areas. This experiment proved unsuccessful, however, and political administration was returned to the county governments and production and income distribution decisions were decentralized to the level of the team, approximately equal to the size of the earlier elementary producer's cooperatives, following the economic crises of 1959–61.[10]

Although the team, consisting of 30 to 40 households, has remained the basic decisionmaking and accounting unit in Chinese agriculture, recent discussions in the Chinese press indicate that the radical goal of making the brigade, equivalent in size to the former advanced producers' cooperatives, and then the commune the decisionmaking and accounting unit remains as a longrun goal. In addition, with the spread of rural small-scale industry and farmland reconstruction projects operated by the commune, that high-level organizational unit is regaining some of its former role in determining the allocation of resources in the rural areas of China. Nonetheless, the most fundamental and enduring institutional transformation introduced by the Chinese

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[8] State Statistical Bureau, "Ten Great Years," Foreign Languages Press, Perking, 1960.

[9] For a discussion of the general economic model, i.e., institutional and functional, organization and policy priorities, pursued by the Chinese Communists in their economic development efforts over the past 25 years, see Alexander Eckstein's paper in this volume, "The Chinese Development Model."

[10] For a more detailed discussion of these institutional changes in the agricultural sector, see the discussion in Robert F. Dernberger, "China's Economic Future," op .cit., and the sources cited in that article.

Communists in the agricultural sector has been the change from household farming which had existed for centuries to collectivized farming by production teams and there is little evidence to indicate this institutional organization will be changed by the new leadership.[11]

State ownership in industry was already significant in 1952, accounting for over 50 percent of the gross value of industrial output, due to the takeover of enterprises owned and operated by the Nationalist government and the bureaucratic capitalists, that is, those capitalists with close ties to the Nationalist government. The remaining privately owned firms were soon subjected to numerous taxes, fines, and labor problems so that in a short time their owners took advantage of the state's offer to buy them out with bonds equal to half the value of the assets of the firm. By 1956, all private enterprises had been absorbed into the socialist sector, with the joint state-private firms accounting for 30 percent of the gross value of industrial output. These joint state-private firms were completely taken over by the state during the 1960's.

Initially, ownership and control of the state enterprises were highly centralized under the economic ministries of the central government, with their input and output quotas being determined in the state's economic plan, Since the late 1950's, however, considerable decentralization has occurred; only key industries being directly under central government control, the largest of the remaining industrial enterprises being owned and operated by municipal and provincial governments. In the rural, small-scale industrial sector, the largest number of enterprises are owned and operated by communes and brigades, that is, are in the collective sector, but the largest share of output in this sector is accounted for by those rural, small-scale industrial plants owned and operated by county governments, that is, those rural, small-scale plants in the State sector.

The production decisions of all these plants, regardless of the level of ownership and control, are incorporated into the state's economic plan and are subject to the next higher level of government's approval. Despite the considerable relaxation of this official centralized control over industry during various periods in the past, recent articles in the Chinese press make it clear that the new leadership intends to reassert the central governments control over the production planning and output allocation of the state enterprises at all levels, Nonetheless, the existing hierarchy of ownership and operation of the state enterprises and the rural, small-scale industries in the collective sector should remain as the organizational characteristic of China's industrial sector.

In the absence of a market system for the allocation of inputs and outputs and of a profit maximization criteria for plant management, these allocation decisions are determined by administrative decisions and included in the state economic plan. After a brief period in which the Soviet system of highly centralized planning was tried, the Chinese implemented a much more decentralized system of planning which increases the participation of the masses at the lower levels of government and economic administration. Over the past decade or more, the state's economic plan has been a combination of decisions made at various levels, with considerable initiative coming from the lower levels. Nonetheless, the central government has always retained its right of final approval of the production and allocation decisions included in the economic plan. This system of decentralized planning has allowed for considerable flexibility and lower level initiative in economic problem solving; a unique feature of Chinese planning.

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[11] At the present time, these units—communes, brigades, and teams—in the cooperative sector are not integrated into the detailed State economic plan. They determine their own production plans, are allocated inputs by the State, pay taxes and sell goods under negotiated contracts to the State, distribute income and provide education and health services to their members. Individual households are allocated small plots and can consume or sell the output of these plots in rural markets that exist for that purpose. If sold on the market, however, key commodities must be offered first for sale to the State trading companies. State farms do exist and are the most mechanized farms in China. Nonetheless, they are not very important in terms of either total acreage or production. Recent statements in the Chinese press indicate the new leadership supports the individual household's private plot production activities and participation in trade on the rural free markets. Recent reports also hint at the possible expansion of state farms and, perhaps, even the incorporation of some of the collective units' economic activity within the State plan.

The central planners, of course, have not been passive participants in the process of resource allocation, reacting to suggestions from below by exercising their veto power when necessary or by making only marginal adjustments in the proposals they received. They directly control and operate the key industries, the transportation network, internal trade in key commodities, and all external trade. Most important, however, is their ability, through their control over the State budget and the banking system, to control financial flows in the economy and to transfer all profits of State enterprises above those retained earnings approved for working capital, workers' fringe benefits, and small investment projects, into investment and expenditure categories determined by the central planners.[12] This ability of the central planners to control the rate and direction of China's economic development will undoubtedly be significantly increased in the future. Recent reports in the Chinese press emphasize the need to reestablish greater central control over production and allocation decisions, that is, planning, in an effort to eliminate the inefficiencies and wastes resulting from the poor coordination and implementation of decentralized planning decisions over the past decade.

Disproportionate Growth and the Major Economic Problems of the Mid-1970's[13]

Utilizing this reorganization of the economy, the Chinese Communists took an industrial sector, limited in size and considerably distorted in structure and location in 1949, and increased its output over the past quarter of a century by more than eightyfold. This remarkable pace of development, the doubling of output every 5 years or a 13 percent annual rate of increase[14] was interrupted twice in the 1960's due to the excess capacity created by the dislocations of the "Great Leap Forward" in the early 1960's and due to the disruptions of the cultural revolution in 1967. Industrial growth was again disrupted due to the turmoil associated with the succession crises in the mid-1970's. Nonetheless, industrial growth over the past 25 years has been rather continuous and rapid, obtained by the greatly increased rate of investment and large share of total investment allocated to this sector. The input bottlenecks and slow growth in other sectors due to this concentration of investment in and the resulting disproportionate growth of industrial production were problems the Chinese leadership had to accept as the price of rapid industrialization.

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[12] For the central government's ability to reallocate the profits of State enterprises by means of their control over the budgets of the lower levels of government, see Nicholas Richard Lardy, "Central Control and Redistribution in China: Central-Provincial Fiscal Relations since 1949," unpublished Ph. D. dissertation, The University of Michigan, 1975. It should be pointed out that there is a difference of opinion in the literature concerning the consequences of China's budgetary process and the considerable decentralization that has occurred in the economy since 1957. Some observers believe the effects of decentralized collection of budget revenue, revenue sharing, and local ownership and management of most enterprises led to the reappearance of cellular, or regional, autonomy over resource allocation in China. See Audrey Donnithorne, "China's Cellular Economy: Some Economic Trends since the Cultural Revolution," China Quarterly, no. 52, pp. 605–619, and several other articles by the same authors. The summary of the opposing view that considerable control was retained by the central government, presented in this paper, does—we believe—represent the conclusions of most observers.

[13] Unless otherwise noted, the statistical data used in this section of the paper is taken from the such readily available sources as Nai-ruenn Chen, "Chinese Economic Statistics: A Handbook for Mainland China," Aldine, Chicago, 1967: State Statistical Bureau, "Ten Great Years," the statistics in the papers included in the previous compendium on China's economy released by the Joint Economic Committee. "China: A Reassessment of the Economy," U.S. Government Printing Office, 1975; or the most recent issue of statistical estimates for China's economy released by the National Foreign Assessment Center, CIA, "China: Economic Indicators," ER77–10508, October 1977. Unfortunately due to the deadlines scheduled for the submission of the papers to be included in this volume and the second volume to be issued later this year, it was not possible to incorporate the economic data presented in these other papers in this introductory paper. Inasmuch as these estimates are used to illustrate general trends or relationships, not as accurate point estimates; the use of one set of estimates rather than another should not change the arguments presented in this paper.

Their economic system, with a centralized budgetary system insuring State control over enterprise profits and a centralized supply system for key commodities providing plant managers their inputs and freeing them from the burden of marketing their output, enabled the State planners to create industrial capacity according to their own priorities, even though disproportionate growth may be a result of those priorities. Critical to this growth of industry, however, was the required supply of capital goods. Since the Chinese began with a small initial industrial base, they were forced to import most of their early requirements of machinery and equipment,[15] one reason for putting a high priority on the rapid growth on the industrial sector rather than on agriculture. These imports, of course, had to be financed by exports of raw materials and processed agricultural products, especially textiles, or the products of those sectors which did not receive a high priority in the allocation of the available investment funds.[16]

Therefore, changes in the structure of industry, and not just growth of total industrial production, was also important. Development of heavy industry, or the manufacture of producers goods for industry, was most crucial if China was to achieve greater self-reliance in its industrial development. As a result, the machine-building, energy, and metallurgy sectors increased at rates well above the average for industry as a whole.[17] These increases in the industrial production of inputs for industry eventually led to serious problems of disproportionate development within industry itself, even within the producers goods sector, as well as throughout the economy as a whole.

For example, the emphasis on the expansion of the industrial production of inputs for industry came at the expanse of two other key producers goods industries; transportation equipment and producers goods for agriculture. Compared with the rate of industrial growth, the rate of track laid lagged behind and the rail network suffered from a shortage of locomotives, resulting in significant increases in traffic density and weight hauled per train. The Chinese have begun producing diesel locomotives to take advantage of their petroleum resources, but this has not significantly altered a situation of increasing weight hauled per train. Motor transport has become a major provider of short-haul transport, but roads are still relatively poor and total annual truck production is fairly small. Although China's rapidly growing supplies of petroleum augurs well for the development of a modern transport system, the Chinese must still make large investment of capital in that sector which do not directly add to increases in output.[18] These investments do, however, provide much of the necessary "social overhead capital" which facilitates the efficient operation of a modern economy. A good transportation network also increases production through efficiencies in input supply to producers and output distribution to end users.

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[14] An index of industrial production in 1957 and 1965–77 is estimated and discussed in Robert Michael Field and Kathleen M. McGlynn, "Chinese Industrial Production," part II, this volume.

[15] See the discussion of the important role played by foreign trade in sustaining and developing the Chinese economy and the appendix tables for estimates of China's imports of producers goods in more recent years in Rich Batsavage and John Davie, "China's International Trade and Finance," part V, this volume.

[16] In the 1950's, Chinese imports of producers goods from the socialist bloc were financed, in part, by some short-term commercial credit and long-term loans. But the Chinese had repaid these debts by 1965—a remarkable record for an underdeveloped country engaged in a large-scale program of industrialization.

[17] For a more detailed discussion of developments in these three key industries, see Robert F. Dernberger, "China's Economic Future," *op. cit.*, pp. 97–99; also see the four papers in part II, this volume, on the machine-building industry, the energy sector, the mineral sector, and the electric power industry.

One of the most important consequences of the concentration of investment fund in investments in those industries producing inputs for other industries was the limitation of investment in agricultural producers goods. The Chinese planners recognized this problem, but their expectations that the reorganization of agricultural production into collective units of production and resulting mobilization of labor effort would lead to large increases in agricultural production proved to be erroneous.[19] Yet, it wasn't until the agricultural crisis in 1959–60 that the Chinese began to significantly expand those industries manufacturing producers goods for agriculture, such as agricultural machinery and equipment and chemical fertilizers. As a result, China has made great strides since 1960 in increasing the horsepower of mechanical pumps utilized in irrigation and of tractors used in cultivation (both larger tractors and smaller "walking" tractors). The main contribution of this increase in mechanization in agriculture was not merely for the purpose of directly increasing output, but to release labor for a wide range of capital construction projects in the rural areas and to allow for increased multicropping and the increased cultivation of more labor intensive, but higher yield, crops.

The growth of the chemical fertilizer industry was the most significant result of the reallocation of investment funds in favor of industries producing inputs for the agricultural sector. Historically, the Chinese have relied heavily on inputs of organic fertilizer and chemical fertilizer has become a significant input in agricultural production only recently. A significant share of this chemical fertilizer is imported, drawing upon China's scarce foreign exchange holdings. Most recently, however, the Chinese purchased 26 chemical fertilizer plants, which will soon be operating at full capacity, more than doubling the total domestic production of 1974.[20]

Although the change in investment priorities in the 1960's has helped to offset the earlier neglect of the production of industrial inputs for agriculture, China's needs in irrigation and drainage equipment, agricultural machinery and equipment, and chemical fertilizer still far exceed domestic supplies. Thus, the continued rapid expansion of these industries remains a necessary condition for solving China's agricultural problem. Increases in the output of these products are very costly, that is, the marginal capital requirements for a unit increase in output are relatively high, and all indicators predict that even as the Chinese increase the use of these inputs, they will encounter declining increases in agricultural production. In other words, the costs will be relatively high and the returns may not be as great as is anticipated.

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[18] This is not to say that the Chinese have been unable, through intensive use of the existing facilities and equipment, to facilitate the growth of output in the economy which actually occurred: the average annual rate of increase in industrial production of 13 percent between 1952 and the mid-1970's was equaled by the rate of growth in tons hauled by the modern transportation sector. Nonetheless, modern transportation is a serious constraint on the margin in that it severely limits the rate of growth in industrial output, the rational and efficient distribution of what is produced, and desired changes in the location and structure of industry. Furthermore, although the modern transportation sector did provide the services necessary to attain the rates of growth actually achieved in the past, it did so by depending on a considerable volume of imports of transportation equipment; one-third of China's total imports of machinery and equipment from the non-Communist countries and one-half China's total imports of machinery and equipment from the Soviet Union in 1961–1973. CIA, "Foreign Trade in Machinery and Equipment Since 1952," A(ER)75–60, January 1975.

[19] See the discussion of agricultural developments in part IV, this volume.

[20] For a more extended discussion of the argument on this paragraph, see Robert F. Dernberger, "China's Economic Future," *op. cit.*, pp. 102–103.

Until recently, many rural areas were unable to gain ready access to the inputs produced in the modern sector. This is due in part to the neglect of investments in the transportation system and in part to the traditional geographical location of industries which was not changed significantly between 1952 and 1973.[21] Through altered patterns of urbanization and their control of rural to urban migration—in fact, their frequent reversal of this normal flow—the Chinese leadership has attempted to redress these problems. Yet, while the emergence of medium-sized industrial centers in the rural areas will reduce some of the demands on the transportation network, the development of these growing new urban centers will greatly increase the need for social overhead capital which does not directly contribute to increases in production.[22]

Finally, the unbalanced growth within industry has placed constraints on the growth of per capita consumption. Through a system of wage controls, the rationing of low-priced necessities, and setting of high prices for consumers durables, the Chinese leadership has been able to control the effective demand for consumers goods and most evidence seems to support the argument that the material standard of living, especially in terms of basic necessities, has not increased significantly since the mid-1950's. There has been, of course, a marked increase in the provision of public goods and services, such as health care, public housing, and education. The increased supplies of consumers durables, that is, bicycles, watches, and radios, has raised living standards somewhat, but these supplies seem to benefit primarily the industrial workers, a small portion of the total labor force. Nonetheless, the average family now enjoys a decent standard of living and deviations from this average are limited.

On the other hand, the new leadership already has adopted policies to reinforce the reliance upon material incentives, and to be meaningful, these policies must be complemented by an increase in investment in consumers goods production. Many of the industries producing consumers goods, however, have experienced periods of excess capacity during the past due to an inability of the rate of growth of agricultural products used as inputs in the consumers goods industries to keep pace with the growth of capacity in that sector. Rapid growth in the output of the consumers goods industries, as well as rapid growth in the standard of living, therefore, depend on the rate of growth of Chinese agricultural production—the main bottleneck in China's economic development as a result of the disproportionate sectoral growth in the past.

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[21] Charles Robert Roll, Jr., and Kung-chia Yeh, "Balance in Coastal and Inland Development," in the previous Joint Economic Committee's compendium of papers on China, "China: A Reassessment of the Economy," 1975, p. 88.

[22] For a more extended discussion of this argument, see Robert F. Dernberger, "China's Economic Future," *op. cit.*, pp. 103–104.

The Chinese leadership, aware of the consequences of placing priority on the development of the producers goods industries, which produced inputs for other industries, as a prerequisite to the development of the other industries, were divided between those, such as Liu Shao-chi, who argued that agriculture could be socialized into large cooperative units only after industrial development allowed for mechanized agriculture, and those, such as Mao Tse-tung, who argued that socialization of the relations of production should precede the mechanization of agriculture. The Maoist position was predicated on the belief that ever larger cooperative units would "unleash" sufficient productive powers through the mobilization of labor which would provide the increases in production necessary to satisfy both the input demand of the nonagricultural sectors of the economy and allow for increases in the standard of living as well. Thus, even without large-scale investments, they believed institutional reorganization would solve their short-run production problems and mechanization would be obtained as a byproduct of the industrialization of the economy in the long run.

The Maoist position won out in the mid-1950's, but it was not long before the short-run contradictions of their position created serious problems for the Chinese. The rate of growth in the gross value of agricultural output fell during the mid-1950's and the annual level of the net grain supply transferred to the state was constant over the period 1956–57.[23] This situation restricted an increase in the supply of food to urban areas, limited the ability of the state to export agricultural goods to finance imports of investment goods, and reduced agricultural products available as inputs for the consumers goods industries. Various economic indicators for 1957 reflect this situation: A decline in nonagricultural employment, a decrease in exports, an increase of only 5.6 percent in the industrial production of consumer goods, and a decline in total capital construction. In fact, 1957's rate of growth for the economy as a whole was the lowest for any year since 1949.

In 1958, the Chinese leadership launched their communization movement and the "Great Leap Forward." Favorable weather and increases in labor force participation and workdays of effort per laborer brought increases of 19 percent in grain output and 25 percent in the gross value of agricultural output in 1958. Bad weather and the delayed negative effects of this extreme socialization policy in agriculture brought on the agricultural crises of 1959–61. Output equal to the level achieved in 1958 could not be achieved again until 1965.[24] As pointed out above, this crises forced the Chinese to reevaluate their development strategy and to recognize the need to solve the agricultural problem by changing their investment allocation priorities for development.

The results of this decision to change the allocation of investment in favor of the producers goods industries producing inputs for the agricultural sectors discussed above and a more detailed discussion of

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[23] David Ladd Denny, "Rural Policies and the Distribution of Agricultural Products in China: 1950–1959," unpublished Ph. D. dissertation, University of Michigan, 1971, p. 41.

[24] In the absence of official data for agricultural production during this period, there is some disagreement in the literature over the magnitude of the declines in output in 1959 and 1960 and the length of the recovery period in the early 1960's. For a representative set of estimates see appendix A in Arthur G. Ashbrook, Jr., "China: Shift of Economic Gears in Mid-1970's," this volume. See also the discussion of developments in this period in papers by Charles Liu, "PRC Agriculture: Performance and Emerging Issues in the 1970's," and by James A. Kilpatrick and Henry J. Groen, "Chinese Agricultural Production," in this volume.

China's attempt to solve the agricultural problem in the 1960's and 1970's and the likelihood of their success in the future is discussed below. It can be noted here, however, that the results thus far have not been striking. Between 1964 and 1974, the average annual rate of increase of grain output was less than 3 percent and the Chinese have had to rely on sizable imports of grain to make up deficits in domestic supplies. Thus, agricultural development still remains the major constraint to overall economic development and increases in the standard of living; that is, it is the fundamental economic problem facing the new leadership.

This brief review was not an attempt to provide a complete or detailed description of China's economic development over the past quarter century but rather a summary of the Chinese leadership's program to gain control of resources and use those resources to achieve rapid increases in heavy industrial production which also resulted in a relatively high overall growth rate and a significant restructuring of the economy. Yet, this successful record was qualified by their failure to follow a more balanced set of priorities, resulting in serious bottlenecks with regard to such other sectors as transportation, consumption, and agriculture; bottlenecks or major problems the new leadership must solve. This is not to say, however, that the pursuit of the traditional socialist priorities in the allocation of investment in the past was unwise. Although not solving all the problems of economic development, the Chinese have created and maintained a substantial industrial base, while maintaining a somewhat stable and adequate standard of living for the population; a significant industrial base which the new leadership can build upon in their attempts to achieve the economic modernization of China.

THE FIXED PARAMETERS OVER THE NEXT DECADE

In their attempts to achieve the economic modernization of China, the new leadership will work within the context of certain fixed parameters. There is probably no dimension of China's economic, social, or political situation that can be safely assumed as absolutely fixed. Nonetheless, several characteristics of the economy are likely to remain stable over the next decade, either because the Chinese decisionmakers will be unable to change them or because they will be unlikely to want to do so. The most important of these concern China's resource base and its economic and political system.

As argued earlier, the fundamental obstacle to economic development in China is the need to solve the agricultural problem. Any solution must take as "relatively fixed" the available area of cultivatable land, its location, its inherent fertility, and the existing climatic conditions.[25] Given these constraints, the Chinese peasants have been able to support almost one-fourth of the world's population with less than 8 percent of the world's cultivated area of land by means of relatively traditional, labor-intensive technology. The Chinese cannot expect to achieve a steady and significant rate of increase in agricultural output from a new lands policy. Rather, increases in output must come from higher yields; the latter obtained by a spread of double-cropping and irrigation, changes in cropping patterns, new seeds, modern input like chemical fertilizer, et cetera. The Chinese are attempting this transformation through the current program of significant technological change and intensive, rather than extensive investment in agriculture.

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[25] See the discussion in the sections on "Resource Endownment" and on "Factors of Production and Modernization" in James A. Kilpatrick and Henry J. Groen, "Chinese Agricultural Production," this volume.

While the success of these programs is crucial to China's development, agricultural transformation is only a necessary, not a sufficient condition for modernization. To adequately develop an industrial base, a country must have access to raw materials and, given the very large size of the domestic market, the success of China's industrial program rests to a considerable extent on China's domestic resource base. The two most critical categories of raw materials for industrial use—namely energy and minerals—are evaluated here as indicative of China's very favorable position in terms of resource endowment.[26]

For example, in terms of energy resources. China is among the front rank in coal, having high-quality and easily mined, but somewhat poorly distributed, reserves. China also has an extensive river system, with the third largest runoff in the world. Although these rivers' geographic features allow for the development of considerable hydroelectric power capacity with "relatively" low construction costs, 73 percent of the hydropower potential is located in the southwest of China at a considerable distance from the centers of economic activity.[27] In the north, silting and irregular flows create obstacles to the utilization of rivers for power supplies. Given China's coal deposits, however, over two-thirds of China's electric power is generated in thermal electric power stations.

The ratio of energy requirements to GNP growth is between one and two for most countries; a 1-percent increase in GNP will require an increase of between 1 and 2 percent in energy supplies. Despite the very favorable endownment in coal and hydropower potential, there have been limits to the rate at which the Chinese have been able to expand their utilization of these resources and the short-run solution to China's energy needs was facilitated by the exploitation of China's petroleum deposits. Until fairly recently, while China was thought to compare favorably to the United States and the U.S.S.R. in hydroelectric power and coal reserves, it was considered low in petroleum deposits. Recent developments and gological surveys have significantly changed that pessimistic outlook to one of optimism.[28] Nonetheless, the long-run solution of China's energy needs will rely on the development of the extensive hydropower capacity, which has been explicitly recognized by the new leadership. While these domestic energy resources are available for the long-run modernization of China's economy, however, the limits on their ability to develop additional capacity rapidly in the short-run will place a constraint on the rate at which the Chinese can expand industrial production over the near future.[29]

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[26] For a detailed survey of China's energy and mineral reserves, see Vaclav Smil, "Energy Production," and Kung-ping Wang, "Mineral Output and Productivity," in this volume.

[27] See William Clark, "Electric Power Industry," this volume, for a further discussion of this point.

[28] The estimates of China's deposits of petroleum are undoubtedly subject to wide margins of error and are being modified as one new deposit after another is discovered. For one review of these estimates, see Selig S. Harrison, "Time Bomb in Asia," Foreign Policy, No. 20, Fall, 1975. In that source, Harrison estimates that "Peking appears likely to reach the current production level of Saudi Arabia by 1988 or soon thereafter." Idie., p. 4. For knowledgeable and more up-to-date estimates, see Vaclav Smil, "Energy Production," and Kung-ping Wang, "Mineral Output and Productivity," in this volume.

[29] For a more detailed analysis of these energy constraints on China's future growth, see William Clark, "Electric Power Industry," and Vaclav Smil, "Energy Production," in this volume

China's mineral reserves seem more than adequate: there are large surpluses of antimony, mercury, molybdenum, tin, tungsten, fluorspar, and uranium; and smaller ones of lead, manganese, zinc, asbestos, and bauxite. In addition, China has sufficient deposits of aluminum, iron ore, graphite, and gypsum. China's most serious scarcities are in chrome (imported from Albania), nickel (imported), copper (aluminum presently substituted for copper in electrical uses), and phosphate for fertilizer production (imported).[30]

This favorable endowment of energy and mineral resources means that China's industrialization and drive for self-sufficiency will not suffer from serious raw-material constraints. Rather, the major problem will be China's ability to accumulate the producers goods necessary to process these resources, which has important implications both for the structure of that industrialization drive over the near future and for China's dependence on foreign trade.[31]

Undeniably, China's richest resource is the Chinese people. Traditional arguments that "surplus" population is a burden in developing countries may or may not be correct; it depends on the relevant economic circumstances. This argument, however, does not apply in China. Several past studies have all shown that China's reliance on the intensification of traditional means for the expansion of agricultural output has resulted in serious labor shortages during the peak periods of production, such as planting, transplanting, and harvesting.[32] Furthermore, due to the scale and level of the efforts to transform China's agriculture by means of rural farmland reconstruction, rural small-scale industries, new patterns of cropping and intercropping, more double cropping, et cetera, these programs have significantly increased the rural labor-force participation rate and the annual workdays of effort per laborer of the agricultural work force during the past two decades. In short, the demands for increased labor efforts in the rural areas can best be described as having led to a situation of "overfull" employment.

While China's present population is a valuable economic resource, China's leaders launched a campaign to reduce the birth rate during the 1960's, despite the excess demand for labor in their short-run attempts to increase agricultural production, in recognition that continued efforts to achieve productivity gains through increased labor inputs with a traditional labor-intensive technology would result in very low marginal productivities for labor. The long-run solution of their agricultural problem, on the other hand, must involve the modernization of Chinese agriculture with both higher productivities of labor and lower demands for labor inputs; that is, a problem of "surplus" population. Hence, the present attempt to bring the rate of population growth under control and even to reduce the rate of growth to remarkably low levels for a developing country. There is considerable debate among Western experts as to the validity of the Chinese claims of success in their birth-control program, but for our purposes in this paper, China's population over the next decade can be reasonably assumed as given, even though our estimate may be subject to a wide margin of error. Taking the results of John S. Aird's "intermediate model" projections, presented elsewhere in this volume, the rate of population growth will decline from 2 percent in the mid-1970's to a relatively stable level of about 1.3 percent by the mid-1980's; total population increasing from approximately 934 million in 1975 to 1,114 million in 1985.[33]

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[30] For greater details of China's mineral reserves, see Kung-ping Wang, "Mineral Output and Productivity," this volume.

[31] In this regard, China does suffer from a shortage of gold and silver, the major commodity reserve assets used in foreign trade. Not being a major producer of these precious metals, the Chinese are unable to maintain sizable import deficits for any considerable lengths of time without relying on foreign loans. This can have, and has had, serious implications for China's economic development program and foreign trade behavior when an unwillingness to borrow abroad, coupled with a decline or lack of growth in export capacity, leads to a serious constraint on imports. The rapid development of petroleum production has helped to alleviate this constraint on China's development program, but it has not eliminated it.

[32] These labor shortages during peak work periods can amount to approximately one-fourth of the labor supply as is indicated in the studies of John Lossing Buck for the 1930's, those of T. H. Shen for the 1940's and the severe labor shortage experienced by the Chinese during the Great Leap Forward in 1958.

One serious problem of China's large population during the next decade will be the balance between the supply and demand of foodstuffs. There is currently a very small margin—if any—between increases in agricultural output and the rate of population growth. Even if the results of Aird's "intermediate model" projections are accepted and the Chinese will be successful in reducing the rate of population growth to the relatively low level of 1.3 percent by the mid-1980's, the Chinese will still encounter serious problems if they are unable to raise the rate of increase in agricultural production well above 2 to 3 percent. These higher rates of growth in agricultural production, that is, higher than those experienced in the past, will be a prerequisite for the accomplishment of the new leadership's program for the rapid economic development of the economy during the next decade. These growing surpluses of agricultural products will be required to meet the needs of the hoped-for increases in per capita consumption, the needs for increased supplies of agricultural products as inputs in the more rapidly growing industrial sector, and the needs of significantly higher levels of exports to provide the necessary foreign exchange to finance the rapid growth in imports required by the large-scale investment program planned for the next decade.

The results of their efforts in the agricultural sector, of course, will have an effect upon the stability of China's political and economic system. On the other hand, the analysis of the possible evolution of China's economy over the next decade which follows explicitly assumes that the present economic and political system will remain fixed, including the moderate-pragmatic type policies being pursued by the new leadership. The Chinese Communists have proven their desire and ability over the past 25 years to feed the population and to maintain an adequate standard of living through good times and bad. Thus, it is believed unlikely that their efforts to achieve increases in agricultural output over the next decade, even if relatively unsuccessful, will generate forces which will lead to significant changes in the existing economic and political system. Furthermore, if the results of their economic policies did prove unsuccessful, a major feature of the new more moderate-pragmatic leadership is its willingness to react quickly with policy changes for the purpose of restoring economic stability and growth.

In addition, the anticipated growth rates of agricultural production over the next decade range between the more pessimistic forecasts presented in this paper (2 to 3 percent a year) and the much more optimistic targets presented by Hua Kuo-feng in his speech to the Fifth National People's Congress (4 to 5 percent a year). The lower forecast would appear to present China's leaders with serious problems, yielding a total grain output in 1975 which is 67 million tons below the target presented by Hua. On the other hand, if the latter target were to be achieved, grain supplies per capita in 1985 will be about 30 percent higher than in 1975. While this swing of 67 million tons of grain is equivalent to one-fourth of China's total grain output in 1975, neither limit of this range of possible results would appear to provide a sufficient reason for expecting a change in China's economic and political system, or the new leadership group in command of that system.

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[33] See John Aird, "Demographic Change in the PRC," this volume.

While drastic changes in the economic and political system due to economic developments is highly unlikely, on the basis of China's history over the past 25 years one must raise the possibility that political conflicts among the leadership may not only be a source of disruption, but also lead to a significant change in leadership and in the economic and political system as well. The possibility of a capitalist restoration, of course, has steadily diminished since 1949, even though Mao and the radicals often accused the moderates-pragmatists' policies as leading to a capitalist restoration. As for a resurgence of a radical leadership, events have shown that possibility was considerably diminished with the death of Mao, the major source of radical support and power. Equally important, the major radical leaders and their followers who had held positions of power in the party and Government have been removed and the more moderate and pragmatic leadership has greatly strengthened its control over the past year and a half. This control of the moderate-pragmatic leadership is attested to by their ability to put "economics" in command and introduce a wholesale program of economics policies based on the need for greater efficiency and economic rationality. The greatest threat to the new leadership is not their political rivals, but the degree to which they will be able to achieve rapid rates of industrialization and a solution of China's agricultural problem.

AN ALTERNATIVE FORECAST OF CHINA'S ECONOMIC EVOLUTION (1975–85)

As mentioned in the beginning of this paper, no details of the long-run economic plan, 1975–85, have been released; Hua's speech to the Fifth National People's Congress only referring to a 4 to 5 percent rate of growth in agricultural production, "over" 10 percent in industrial production. His discussion of the planned growth in light industry, heavy industry, the standard of living, and in foreign trade is presented in nonquantitative terms, but clearly indicates that these targets are equally ambitious; Hua describing them as "gigantic tasks." The forecasts presented here as an alternative forecast for 1985 are much more pessimistic. The reason for this is that they are derived on the basis of the actual developments in China's economy in the past, the fixed parameters the new leadership will be working with in the future, and the dictates of economic analyses and theories Western economists have formulated on the basis of the historical experience of economic development in the West.

The Chinese, of course, would object to this approach as they have explicitly argued their own economic development has proven these static-equilibrium, Western theories to be meaningless. We do not believe their past development has shown these theories to be wrong and, more important, we do not share their faith that they will be able to prove them wrong over the next decade. This is the essential distinction between our "pessimistic" forecasts and the "optimistic" targets for 1985 presented by Hua. Actual developments, of course, will undoubtedly show that the truth lies somewhere between these two extreme positions.

The most fundamental economic problem faced by the Chinese remains that of achieving a rate of growth in agricultural production well above the rate of population growth. This problem can be reduced to a simple question of the production possibilities in the agricultural sector. Failure to achieve and maintain a rate of growth well above 2 percent would mean the continuation of existing constraints on China's ability to maintain sustained economic growth and to obtain higher standards of living for the population, a problem that the new leadership has shown it is well aware of and desires to solve.

Agriculture

Even though the Chinese leadership now recognizes that the agricultural problem is the prime obstacle to the economic development of China and assigns its alleviation one of the highest priorities in their development program, the achievement of an average rate of growth in agricultural production of well over 2 percent will not be easy. Historically, China's agricultural development between the 14th and the 18th centuries did little more than keep pace with the 0.5-percent growth in population. Furthermore, Dwight Perkins estimates growth was even lower in the 19th century (with declining per capita output) and less than 1 percent in the first half of the twentieth century (again, approximately equal to the rate of population growth).[34] Thus, traditional agriculture was able to keep pace with population growth, but at an average rate of growth far below 2 percent. Furthermore, Perkins estimates that approximately half of this increase in production resulted from increases in cultivated area. By the middle of the 20th century, this source of growth was no longer available, and further increases in output relied more heavily on attempts to increase yields, largely within the framework of traditional, labor-intensive technology.[35]

Since 1949, annual output estimates do not reveal a significant trend, either upward or downward, in the approximately 2 to 3 percent annual rate of increase of agricultural output. Furthermore, neither increased multicropping—already at a relatively high level—nor mechanization—now at a relatively low level—would appear to offer the solution of China's agricultural problem. While there is still room for the expansion of double cropping in the north and triple cropping in the south, it would appear the Chinese leadership is placing far too great a reliance on this means for sustained increases in agricultural output. As for mechanization, any form of mechanization which simply displaced rural labor from agricultural production would not lead to increases in output, merely free labor to serve as inputs in other sectors. What is hoped, of course, is that the mechanization will relieve the pressures on the agricultural labor force during peak work periods, such as transplanting, harvesting, or threshing, making more labor available for other tasks, such as increased multicropping; the increased labor in these other tasks expected to increase output significantly. Thus, an increase in mechanization is now being pursued by the new leadership as one of the most urgent tasks in agriculture, even though, in and of itself, the increased mechanization will not directly lead to the increased output being sought.[36]

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[34] Dwight H. Perkins, "Agricultural Development in China, 1368-1968," Aldine, Chicago, 1969. See particularly the discussion in chap. II. Much of the analysis in this section of the paper parallels the discussion in Dwight H. Perkins, "Constraints Influencing China's Agricultural Performance," in the previous compendium of papers on China's economy issued by the Joint Economic Committee, "China: A Reassessment of the Economy," 1975, pp. 350-365.

[35] For a more detailed discussion of how the Chinese Communists have attempted to increase yields within the framework of their traditional, labor-intensive agriculture, see Thomas Wiens, "Evolution of Policy and Capabilities in Chinese Agriculture Technology," and James A. Kilpatrick and Henry J. Groen, "Chinese Agricultural Production," in this volume.

In recent years, one of the greatest sources of increased yields has been the adoption of better seed varieties for the traditional crops in conjunction with a program of increased applications of chemical fertilizer. Throughout the 1970's, the Chinese leadership has emphasized the importance of chemical fertilizer as a source of agricultural development, diverting significant resources to the expansion of its domestic production, its import, and the import of complete plants for its production. The costs of this program of obtaining greater supplies of chemical fertilizer, however, is only one of the problems involved in achieving higher yields through the greater application of chemical fertilizer. Transportation costs, limited storage facilities, and the loss of nitrogen content during transportation and storage have resulted in most of the new plants purchased abroad being located in the interior; that is, in the major centers of agricultural production.

In addition, due to these same problems, the Chinese produced approximately one-half the production of nitrogen in small-scale rural industries. These rural, small-scale plants produce fertilizer that is considerably poorer in quality than that produced in the large, modern plants. It must be noted, however, that the higher potassium and phosphorous content of the organic fertilizer used on a very large-scale by the Chinese complements well the nitrogen in the chemical fertilizer produced in the rural, small-scale plants. It is mainly in the more sparsely populated, less accessible agricultural regions that the quality and quantity of chemical fertilizer produced will be critical to the achievement of the higher yields the leadership hopes to obtain.[37]

The Chinese peasants have accumulated a vast storehouse of knowledge over the past six centuries or more within the confines of their traditional agricultural technology. Agricultural handbooks concerning new seeds and the use of chemical fertilizers for the various crops grown on different soils are available throughout the countryside.

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[36] See, "Farm Mechanization: Targets for 1980," Peking Review, No. 8, Feb. 24, 1978. It is interesting to note that these targets were replaced by those for 1985 included in the longrun economic plan adopted by the National People's Congress less than a week after the above cited article was published.

[37] See the discussion of these problems in James A. Kilpatrick and Henry J. Groen, "Chinese Agricultural Production," and Charles Lin, "PRC Agriculture: Performance and Emerging Issues in the 1970's," in this volume.

Demonstration plots, discussion meetings, and technical teams sent to the countryside reinforce the dissemination of new information. Nonetheless, contrary to their record in the past, it is most essential that the Chinese undertake a significant program of advanced basic research in the testing and selection of new seeds if they hope to modernize Chinese agriculture and achieve yields on a par with those in the most advanced countries by the end of the century.[38]

Another major obstacle which the Chinese must confront if they are to solve their agricultural problem is the storage and control of water—essential for achieving the potential yield response catalyzed by increased use of new seeds and increased applications of chemical fertilizer. Historically, water management was critical to Chinese agriculture's ability to support a large population with limited cultivatable land. It was the existence of an extensive irrigation network, mostly in the southern regions, that allowed for extensive double cropping. By the 1930's, most cultivatable land with no serious problems of water supply had been irrigated. Since 1949, the Chinese have increased the irrigated acreage significantly by utilizing flood control projects, wells, and electric pumps. They completed the irrigation network in south China, expanded the irrigation and rice double-cropping area northward into central China (north of the Yangtze River), and increased the irrigated acreage in the southwest and northeast.

The rice-growing areas of South China with adequate and dependable water supplies, therefore, are already irrigated and have been provided with new and rapidly growing supplies of chemical fertilizer. While the leadership has some concern over the lack of growth in this region in recent years, yields in China's rice bowl, Szechuan, compare favorably to those of the other rice-producing countries in Asia. Thus, where the Chinese have managed to develop the necessary complement of inputs, the results have been impressive and have been responsible for China's ability to maintain the average annual 2 to 3 percent rate of increase in agricultural production in the past.

The north China plain, China's traditional agricultural region and the home for over one-fifth of its total population, is primarily devoted to dry land wheat cultivation and suffers from inadequate and undependable supplies of water, resulting in low and unstable yields. High silt content of the Yellow River makes water control and irrigation projects costly, difficult, and often inefficient. Similarly, when rainfall is insufficient, droughts occur and the Yellow River may even dry up. In fact, conditions are so unstable that both flooding and drought can occur in the same year.

The Chinese have undertaken the Yellow River project, designed to regulate flooding by means of a series of storage dams closer to the river's source and to alleviate silting by implementing soil erosion control in the wastelands through which the river flows. In addition, attempts are being made to create facilities for the continuous removal of silt downriver. The costs of this project are tremendous and the returns in terms of increased irrigated land is estimated to be only about 7.5 percent of China's irrigated area in 1974. It is perhaps in recognition of this that recent reports indicate the Chinese leadership has reduced the priority they formerly gave to the Yellow River project as a means for solving their agricultural problem in North China. To add to the irrigated area, the Chinese have been rapidly expanding the number of tube wells equipped with electric pumps for tapping the ground water under the north China plain.[39] These various projects, however, must be well coordinated and carried out on a very large scale, and their ability to achieve high and stable yields in north China is still constrained by the natural supply of water.

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[38] For a detailed discussion of the weaknesses and shortcomings of the process by which innovations have been adopted and implemented by the state in China's agriculture sector in the past, see Thomas Wiens, "Evolution of Policy and Capabilities in Chinese Agriculture Technology," in this volume.

Some observers have argued that China has not been able to achieve more substantial increases in agricultural output due to unfavorable constraints imposed by the reliance on traditional agricultural production techniques and that past growth was largely the result of one-time shifts in inputs which will not be available for sustained growth in the future.[40] Obviously aware of these arguments and of the implications they have for China's economic modernization in the 1970's, the Chinese adopted a major policy decision regarding the means for achieving sustained growth and higher yields.[41] This large-scale, nationwide program involves the identification and emulation of "model" communes and countries that have been able to achieve rapid increases in yields. The unit actually selected as the original model for copying is the Tachai Brigade and the Tachai-type advanced county campaign presents a broad-ranging and interdependent package of policies which are to be copied as the "model" for the modernization of Chinese agriculture.

A brief summary of the major features of these model units which are to be transferred elsewhere indicates the bold and radical nature of the agricultural transformation being sought. While there is some questions as to the status of this campaign under the new leadership, Hua's speech still called upon the Chinese to pursue more vigorously the movement to "learn from Tachai" in their efforts to develop agriculture. This is not surprising, inasmuch as Hua is identified as a key figure in the adoption of the Tachai-type or advanced country model campaign for the modernization of Chinese agriculture. Thus, although it may be modified to some extent by the new leadership, the various ingredients of the campaign remain as the major focus of current Chinese efforts to solve their agricultural problem.

One area in which the new leadership has changed the nature of the campaign is in regard to its organizational and incentive objectives.

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[39] According to the data collected by Dwight H. Perkins, there was no significant increase in irrigated acreage between the mid-1950's and the mid-1960's, and the share of total arable land that was irrigated in the mid-1950's was 31 percent, compared with 27 percent in the 1930's. Between the mid-1960's and mid-1970's, however, the amount of irrigated acreage was increased by almost one-third and the share of irrigated land in total arable land increased to over 40 percent. During this same period, the number of tube wells with power pumps increased thirteenfold. See table 6 in Perkins, "Constraints Influencing China's Agricultural Performance," in op. cit., p. 360.

[40] See Perkins, "Constraints Influencing China's Agricultural Performance," and Alva Lewis Erisman, "China's Agriculture in the 1970's," in the previous compendium of papers on China's economy issued by the Joint Economic Committee, "China: A Reassessment of the Economy," 1975.

[41] This nationwide campaign, known as the Tachai-type or advanced county campaign, includes a great many different, but complementary, activities for achieving modernization of China's agriculture and producing high and stable yields throughout rural China. Furthermore, the emphasis given each of these activities has changed over time. The following discussion in the text in this paper summarizes those activities which are most fundamental to this campaign and which are still important policies of the new leadership for solving China's agricultural problem, whatever the current status of the campaign as a whole. For a discussion of the evolution of the campaign, see Robert F. Dernberger, "China's Economic Future," op. cit., p. 134–138. It is interesting to note that the meeting of national representatives at Tachai Brigade in Shansi Province in the fall of 1975, convened by the State Council and which formally adopted the campaign as national policy, was chaired by Hua Kuo-feng.

Originally, the campaign placed emphasis on the larger production units, such as the brigade, as the basic decisionmaking unit in agriculture and on collectivized activities and distribution. The new leadership, on the other hand, has explicitly recognized the need to rely on the production team as the basic decisionmaking and accounting unit in agriculture and on task-related material rewards for the individual as the basic incentive system. The new leadership also has emphasized its support for the individual household's participation in subsidiary activities, including work on their private plot, and their right to participate in rural, free markets; insofar, of course, as this does not involve speculative behavior or cut into their work obligations for the collectivized activities of the team. In other words, the more radical aspects of the campaign have been removed in favor of greater moderation, but many other elements of the campaign remain.

For example, farmland throughout China is to be considerably remoulded into bigger and level fields to allow for the introduction of mechanization and irrigation. Local networks of water control and irrigation projects are to be completed, collecting water from any and all sources and providing facilities for the storage of water and its distribution to the fields.[42] Land reclamation projects are also important, including such innovations as the moving of spring runoff channels and rivers underground through tunnels of considerable length, allowing for the cultivation of crops in the former riverbeds. In addition, cropping patterns are being changed. Where water is available, wheat and corn are being replaced by higher yield crops such as rice, and intercropping is being widely introduced to allow more efficient use of the available sunlight and land, and to lengthen the annual period during which crop growth may take place.

Rural, small-scale industries which rely on local financing, raw materials, and labor are being constructed to supply the cement, chemical fertilizer, electricity, and agricultural machinery required by this program of agricultural transformation. Mechanization is an important ingredient in the program as a means to increase the available supply of labor to help meet the large increase in the demand for labor resulting from the farmland construction, changes in cropping patterns, and the small scale industry undertaken as part of the program. Electrification is being carried out as a source of power for the mechanization of agriculture, to light up the threshing floor at night to allow for continuous threshing, and to mechanize food processing (for example, grain milling), which now places a heavy demand on rural labor.

Finally, and very important, technical innovations are to be made in all aspects of the production process. Originally, these innovations were to be discovered and developed by the peasants themselves; the scientists and technical personnel were expected to go down to the rural areas and work with the masses. The new leadership, however, has put great emphasis on the need to develop China's scientific and technological capabilities by relying on the training of experts, of acquiring the most advanced knowledge available abroad, by developing the necessary facilities for basic research, and to test new innovations more carefully and adequately before they are introduced in actual production. In this way, the new leadership obviously believes they can better achieve those innovations which will lead to sustained growth in agricultural production.[43]

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[42] These projects were among the most impressive sights observed by one of the coauthors during his trip to China in 1975. Even though one would have to assume that the real wage and interest rates were close to zero (the opportunity costs of labor and capital were very small) to justify their construction in a traditional cost-benefit analysis, one could not help but admire the Red Flag Canal (which brought water to Lin County from a river a considerable distance away in another province), children in the mountains chipping rocks for the construction of a large water storage tank, underground dams to trap the underground flow of water, and a network of aquaducts to distribute water from a pumping station throughout the communes' fields by means of gravity.

The results of these efforts on a few model communes during the 1970's have indeed been impressive. In fact, it was the observed results for these model communes which led the Chinese leadership to adopt this program calling for the nationwide emulation of what the model communes had done as the means of solving China's agricultural problem. Yet, their failure to appreciate the extent to which locational (being near large cities, having good transportation facilities, et cetera), historical (being located in areas of traditionally high yields), or special (receiving considerable state aid) factors explained these satisfactory results, it is very doubtful that other areas, that is, those with low and unstable yields, will be able to easily emulate the experience of these model areas. Most important is the key role played by the availability of water in the achievement of this hoped for transformation of China's traditional agriculture. Quite simply, there are a good many social, economic, and technical constraints which limit the suitability of Tachai-type or advanced county campaign for serving as the solution to China's agricultural problem; constraints which will at least significantly restrict the kinds of increases in yields which have been observed in the model communes.[44]

In other words, the Chinese are unlikely to achieve a breakthrough during the next decade in their attempt to solve the agricultural problem. As a result, agricultural development will continue at the pace of 2 to 3 percent, remaining as the major constraint on China's overall economic growth and on significant increases in the standard of living of the Chinese people.[45]

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[43] See the speeches by Teng Hsiao-ping and Hua Kuo feng to the National Science Conference, attended by approximately 6,000 representatives, held immediately after the Fifth National People's Congress in March of 1978. These speeches can be found in Peking Review, No. 12, March 24, 1978 (Teng's speech) and No. 13, March 31, 1978 (Hua's speech). The document discussed and adopted by this conference was titled the Outline National Plan for the Development of Science and Technology, 1978–85. As is true of the long-run economic plan, 1975–85, this new policy adopted for the development of China's science and technology is merely the "rehabilitation" of a plan originally sponsored by Teng Hsiao-ping in 1975. Due to pressures from radical leaders, then able to use Mao's critical support, these plans were shelved in 1975 and Teng Hsiao-ping was removed from his positions of power.

[44] There may appear to be an inconsistency in the argument in this section of the paper. On the one hand it is argued that the Chinese will find it increasingly difficult to utilize the means used in the past (that is, irrigation, double cropping, etc.) to obtain greater agricultural growth in the future and that the marginal productivity of current inputs (that is, fertilizer, et cetera) will decline as their level of use increases. In other words, the Tachai or Advanced County Campaign won't work as a means of achieving a breakthrough in China's agricultural problem. Yet, in the following paragraph in the text, we argue that agricultural growth in the future is likely to remain what it has been over the past decade or so. These arguments are made compatible for the following reasons. Although given increases in agricultural output will become more difficult (that is, more costly), the Chinese leadership has already decided to devote the resources necessary for obtaining increases in output on a much greater scale than in the past. Although the marginal productivity of current inputs on each piece of land declines with increases in the level of inputs used, the growth of agricultural output throughout China in the past was due, in part, to the increase of these inputs in certain areas of China. Thus, diminishing returns should become an important problem in those areas, but Chinese agriculture contains many areas where the use of these inputs still has a relatively high marginal productivity. Quite simply, although the expected returns obtained, on the average, from a given amount of investment and effort in Chinese agriculture in the future is smaller than in the past, the expected increase in the total scale of efforts and attempt to create a more balanced and complementary mix of inputs over a larger area should enable the Chinese to maintain a rate of growth in total agriculture approximately equal to that in the past.

[45] The same conclusion was argued in the two articles on agriculture in the previous Joint Economic Committee compendium of papers on the Chinese economy: Dwight H. Perkins, "Constraints Influencing China's Agricultural Performance," and Alva Lewis Erisman, in "China: Agriculture in the 1970's," China: A Reassessment of the Economy, 1975." It also is consistent with the agricultural papers presented in this volume: Charles Liu, "PRC Agriculture: Performance and Emerging Issues in the 1970's," and James A. Kilpatrick and Henry J. Groen, "Chinese Agricultural Production."

Industry

Increases in industrial production are obtained by increasing either the amount of physical capital, raw materials, and labor used for production or the productivity of these inputs. Since China is adequately endowed with raw materials and labor supply, the dominant constraint on its industrial development is the need to maintain its recent rate of investment in physical capital. The significant industrial growth since 1949 was made possible by a very high rate of investment.[46] Despite the claims made in Hua's speech, that is, more total investment in 1978–85 than in the entire previous 28 years, the Chinese will have greater difficulty in maintaining both that high rate of investment and, more important, the rate of return on that investment in the coming years.

Although a host of arguments can lead to this conclusion, only the signal reasons will be presented here. The damping of the rate of investment will result from the pressures tending to increase the rate of consumption. Because of rationing and the relatively stable real wages that have existed for the past few decades, considerable pent-up demand undoubtedly exists for higher standards of living. In recognition of this problem, the new leadership announced pay increases for approximately 60 percent of the industrial workers, that is, those in the lower wage scales, during the past year. But, if the Government is to continue to use material incentives, it will have to effect steady increases in wages in order to obtain increases in productivity. Since agricultural production is growing only slightly faster than population, rapid increases in manufactured consumer goods, especially durables such as bicycles, sewing machines, watches, radios, et cetera, may alleviate this problem somewhat but will not solve it.

The source of the demand for a higher standard of living is found in both the industrial and the agricultural sectors. Nonetheless, the fact that industrial workers already enjoy a relatively high standard of living has forced Peking to control strictly the rate of migration from the rural areas to the urban industrial centers. Although the recent drive to create rural, small-scale industries has reduced the rural-urban differences in income levels, it has not significantly altered the differences in income between industrial and agricultural workers.[47] The relatively low standard of living of the average Chinese peasant, its slow rate of growth, the longstanding promise of equitable income distribution, and the necessity to sustain both the labor effort and political loyalty of the peasants will create a pressure that the Chinese leadership will be unable to deny to devote a greater share of the total GNP to consumption.

Whatever the rate of investment in the future, the growing importance of several alternative claims on investment will tend to reduce the share that has been allocated to industry—especially the producer goods sector—over the past 25 years. The higher priority of agriculture will result not only in a smaller share of investment for industry, but also in a much greater percentage of that share going to industries that produce inputs for agriculture—chemical fertilizer, agricultural machinery, irrigation pumps, et cetera. A significant percentage of these goods are produced in rural, small-scale industries developed through investment at the local—especially the county—level. However, this greater share of investment at the local level reduces the investment that might be made in the modern industrial sector by the central government.

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[46] Gross domestic capital formation accounted for approximately one-fourth of gross domestic product during the 1950's; more than half of this capital accumulation was in the industrial sector. Reliable data are not available for the 1960's or 1970's, but the Chinese undoubtedly maintained an investment rate above 20 percent and although agriculture has enjoyed a much higher priority since the 1950's, approximately 40 percent of total investment must still go to industry.

[47] This refers to national averages and does not include those individual communes that have become quite prosperous and whose members enjoy a standard of living quite similar to that of industrial workers. Most of these prosperous communes are to be found in the neighborhood of large metropolitan centers; thus they have large markets close by in which to sell their subsidiary products.

Other budget items also reduce the investment funds available for the industrial sector. Among these are increasing expenditures on public consumption and social overhead capital, such as hospital and medical facilities, educational facilities, and public housing projects. Although there has been rapid growth over the past 25 years, much still remains to be done.[48] Transportation facilities—including the rail, river, and highway network—will also have to be maintained, improved, and increased, not simply to keep pace with industrial development but to alleviate the existing problems as well. The lack of adequate transportation facilities has caused serious problems for the coordination of distribution and supply which can be expected to increase with continued industrial growth. With the share of investment thus reduced, the rate of growth of industrial production is also likely to decline in comparison with the rates of the past 25 years.

Finally, whatever the share of investment allocated to industry, the annual output per unit of investment will also decline because of the shift in favor of the more capital-intensive industries and the modernization of existing industries. Having developed its basic industries to the point where it is relatively self-sufficient in energy, basic machine tools, and metals, China requires in the future the development of industries with significantly higher capital-output ratios. According to a study of China's energy consumption in 1966–74, each 1 percent increase in GNP required a 1.42 percent increase in energy supplies, meaning a GNP elasticity of 1.42.[49] The provision of this supply will depend much more than it has previously on the extraction and processing of petroleum and the harnessing of hydroelectric power potential. Even the continued expansion of the coal industry will depend on the use of more modern mining and refining equipment for the more intensive exploitation of China's huge coal resources, rather than on the earlier labor-intensive methods.

In the machine-building and metal industries, the prospects are similar. Continued economic development with a higher number of continuous production runs, more production of standardized parts, higher quality and precision products, and more automation will increase the already existing demand for a greater amount and variety of task-specific, precision, complicated machinery, such as headless, precision grinders rather than basic surface grinders. These machines will be required not only to equip factories that will be constructed in the future but also to modernize most existing factories. Some of these machines are already produced in China in limited numbers, but the scale of production must be increased significantly.

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[48] Much of this public consumption is provided for by local units in China, especially the commune and the factory. Nonetheless, investments at this level still reduce the potential for investments in the modern industrial sector.

[49] CIA, China: "Energy Balance Projections," A(ER)75-75, November 1975, p. 14.

A unique feature of Chinese industry is the creation of construction, maintenance and repair, and equipment-production facilities within each factory. A significant portion of the capital accumulation and modernization in the industrial sector is provided by these machine shops that produce their own equipment, which tends to be the more basic or standard pieces. The task of the modern machine-building sector will be to create a domestic supply capability for the more sophisticated machinery and equipment that China's economic development will require.

Among these needs for machinery and equipment are the demands of China's defense establishment, agricultural sector, transportation sector, and the rapidly growing chemical industry (fertilizer and synthetic fibers). Even if China hopes to maintain only a conventional, but modern, military force, it would require the production of the most modern and up-to-date aircraft, ships, and weaponry. Any attempt to develop and maintain even a limited missile system with nuclear capabilities would involve relatively high capital and skilled labor costs, not to mention research and development expenditures. The larger and more efficient of the agricultural machinery plants in the rural industrial sector are equipped with modern machinery and are introducing assembly-line serial production. Engines for larger pieces of agricultural machinery are produced in the modern, large-scale industrial sector, where the capital-labor ratio is higher than the average ratio for all Chinese industry. The transportation sector has a great need for trucks and equipment used in building and repairing roads. The production of these goods—an area in which the Chinese have been beset by problems of effective operation—must also be greatly expanded. China's development of the transportation system also will lead to the production on a larger scale of diesel engines, tank cars (for petroleum), and sealed-container carriers (for aqueous ammonia).

In the metal industry, serious bottlenecks remain in the production of finished rolled steel—a very important product in an industrialized country—and of high-quality alloys. Furthermore, the attempt to increase the variety and quality of metal products will require the development of purification and benefication facilities for improving the quality of the raw materials (iron ore and coal).

The above discussion assumes the Chinese will attempt to increase not only the absolute level of production of these relatively capital-intensive industrial products, but also their share in total industrial production. This intent is reflected in Hua's speech and also in the rapid growth in the 1970's of imports of these types of machinery and equipment, chemical fertilizers, and metals, which due to the constraints on China's export capacity, resulted in a serious balance-of-payments problem for China. This problem, reinforced by a basic development policy which calls for the long run self-dependency of China's economy, resulted in Chinese purchases of complete plants for the chemical, metals, and petroleum industries, all of which are very capital-intensive industries.

The net effect of these tendencies in the rate, allocation, and productivity of investment on the rate of industrial growth is difficult to estimate. Undoubtedly, labor productivity will increase as a result of the new leadership's campaign to strengthen central control over the planning and management system in industry and to enforce stricter discipline and specialization within the labor force. The overall impact of these contrasting negative and positive changes, however, should be a reduction in the rate of China's industrial growth over the next decade compared with the very high rates of growth achieved in the past. Thus, the rate of growth of China's industrial sector may well fall to an average annual rate of 6 to 8 percent over the next decade.[50]

Consumption

Recent articles in the Chinese press and statements in Hua's speech clearly reveal the new leadership's intention to rely on material incentives as the major stimulus for increased labor productivity and to secure increases in the standard of living for the labor force out of the resulting increases in output to maintain morale. The Chinese have steadily increased the share of cultivated area devoted to food crops and reduced the share devoted to industrial crops. This shift in cropping patterns, along with the use of rationing to enforce the more equitable distribution of the limited supplies, has enabled the Chinese leadership to assure a level of approximately 2,000 calories of food consumption per day for the population. The continued slow growth in foodstuffs production, however, will undoubtedly mean that the large-scale net import of foodstuffs will continue into the immediate future.[51]

Given these constraints on the domestic production and import capacity of foodstuffs, significant increases in the standard of living must be accompanied by increases in the share of total consumption accounted for by public consumption and manufactured consumer goods. Since 1960, there has been a slight reallocation of investment in industry from investment in the producers goods industries in favor of the consumers goods industries. Thus, while the rate of growth of output in the consumers goods industries is still lower than the rate of growth in the producers goods industries, the gap between these two rates of growth has been reduced. This gap in favor of the producers goods industries, given the priorities of the new leadership, will continue, but the rate of growth of light industrial production will considerably exceed the rate of increase in the standard of living.

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[50] See the papers by William Clark, "Electric Power Industry" and Jon Sigurdson, "Urban-Rural Relationships: Technology and Manpower Policies," in this volume, which present the reasons why energy constraints and shortages of middle-level technical and engineering personnel will prevent the Chinese from achieving industrial growth rates of 10 percent. Also see the paper by Robert Michael Field and Kathleen H. McGlynn, "Chinese Industrial Production," this volume, for estimates of contemporary rates of growth and structural changes in the industrial sector.

[51] The average level of these net foodstuffs imports may well increase even slightly faster than population growth, depending on how rapidly the new leadership desires to increase the standard of living. Their level, of course, will fluctuate from year to year, depending upon the size of the harvest in the given and in the previous year.

Although the ratio of the rates of growth in heavy industrial production to light industrial production will decline to something like 1.5 to 1, both rates of growth will be somewhat less in the future than they have been in the past; that is, decline to 9 to 10 and 6 to 7 percent, respectively. The reasons for a decline in the rate of growth of output in the producers goods industry have been outlined above. As for the light industrial sector, output in that sector is heavily dependent on agricultural inputs and, hence, will be seriously constrained by the relatively slow rates of growth of agricultural output. Furthermore, to maintain necessary increases in the production of foodstuffs, foodcrops will continue to be given priority over industrial crops in the use of cultivatable land. Therefore, the inability to significantly increase the production of these industrial and commercial crops can be expected to lead to Peking's continued reliance on the rationing of such products as textiles and edible oils and the dependence on imports to sustain the increased production of industrially produced consumer goods.

Foreign Trade

As long as the new Chinese leadership adheres to the present policy of self-dependency in foreign trade, that is, does not seek long-term foreign loans, the magnitude of the import requirements which follow from the very large-scale investment and industrial development program outlined in Hua's speech can only mean that foreign trade will remain as a very severe bottleneck to China's future economic development. Without foreign borrowing, China's import capacity is limited by export earnings and China's exports will continue to be dominated by the export of raw and processed agricultural products and raw materials. Not only does our forecast indicate that the rate of growth of China's agricultural production over the next decade will be relatively low, the domestic demands for that output will be increasing rapidly: that increase in demand coming from the increasing standard of living, the growth of the urban industrial labor force, and the growth of the consumers goods industries. As for raw materials, although well endowed in minerals, the Chinese must rapidly expand their exploitation of these resources for the purpose of satisfying their own needs of industrialization.

Quite simply, if the new leadership plans to achieve the targets for agricultural and industrial growth presented by Hua for 1985, the very attempt to achieve those targets will put tremendous pressure on the new leadership to seek foreign loans to remove this constraint on China's future growth. Yet, perhaps due to their experiences with the Russians during the 1950's and due also to its being a fundamental ideological principle over the past two decades, the Chinese leaderships has yet to change their policy of being unwilling to engage in long-term borrowing to finance their import needs. Western experts, and even the Chinese themselves, have offered the opinion that China's development of petroleum exports may be the means for alleviating the constraints placed on their import capacity. Indeed, petroleum exports have become an important and growing export commodity and will play an important role in their barter-trade with Japan over the next decade. Nonetheless, China's domestic needs for energy as a result of industrialization and both technical and economic difficulties in obtaining ever-growing supplies of petroleum for export will limit the ability of this "liquid gold" to solve China's balance of payments over the next decade.[52]

In any event, the rapid growth in China's exports over the past decade is included in the past trend of China's export capacity, which is used here to forecast the growth of China's exports in the future. In making this forecast, our pessimistic forecast, we assume the Chinese will not engage in borrowing long-term loans from abroad, although even with our pessimistic forecast there will be tremendous pressure on them to do so. On the other hand, it is very difficult to imagine how they can realize the very optimistic forecast presented by Hua without long-term borrowing from abroad.

The procedure used to obtain a forecast for the likely trend in China's exports between 1975 and 1985 is really quite simple. The statistical relationship between the rate of growth of exports and rate of growth of China's GNP was quite stable over the past 25 years, as was the relationship between the rate of growth of exports and the rate of growth of agricultural production. Using either ratio and our forecast for the rate of growth of China's GNP and agricultural production over the next decade, the resulting forecast of the growth of exports is the same: 5 to 6 percent.[53] Thus, assuming that there will be no changes in current policy regarding foreign borrowing or investments and in the desired level of self-dependency or foreign trade dependency, the likely rate of growth of both China's imports and exports over the next decade is approximately 5 to 6 percent. Whether or not they should or will be forced to change these policies is, of course, one of the most important policy questions facing the new leadership and is one of the major policy options they face which is discussed in the next section of this paper.

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A convenient summary of each of the above forecasts for the growth of China's economy over 1975-85 and their comparison with those included in Hua's speech to the Fifth National People's Congress is presented in table 1. The comparison readily shows why those resulting from the analysis in this paper can be labeled "pessimistic" and those presented by Hua labeled "optimistic." Yet, it is important to recognize that even the set of more "pessimistic" estimates indicates the new leadership should be able to achieve considerable progress in the economic modernization of China by 1985.

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[52] See the papers by Hedija Kravalis, "China's Export Potential," and Kung-ping Wang, "Mineral Output and Productivity," this volume.

[53] This forecast is also consistent with that implied in the paper by Hedija Kravalis, "China's Export Potential," in this volume.

TABLE 1.—FORECASTS OF ECONOMIC INDICATORS FOR CHINA'S ECONOMY, 1985

		Our "pessimistic" forecast		Hua's "optimistic" forecast	
	Base year absolute level, 1975	Annual rates of growth, 1975-85, percent	Absolute level, 1985	Annual rates of growth, 1975-85, percent	Absolute level, 1985
GNP (billions of 1976 U.S. dollars)	[1] 323	[5] 6.5	[8] 606.1	[15] 8.4	[8] 722.7
Agriculture	[2] 86.1	[6] 2-3	[9] 110.2	[16] 4-5	[17] 133.7
Industry	[2] 176.2	[5] 8.5	[10] 396.1	[16] 10-11	[18] 478.2
Consumers goods	[3] 67.4	[6] 6-7	[11] 126.5		
Producers goods	[3] 108.8	[6] 9-10	[12] 269.6		
Services	[2] 60.7	[7] 5.1	99.8	[7] 6.2	110.8
Population (millions)	[1] 935	[5] 1.8	[13] 1,114.0	[15] 1.8	[13] 1,114.0
Per capita GNP	345	[6] 4.7	544.0	[15] 6.5	649.0
Per capita consumption	[4] 207	[6] 4.7	[4] 326.0	[15] 6.5	[4] 389.0
Foreign trade (billions of U.S. dollars):					
Exports	[1] 7.0	[6] 5-6	[14] 12.0		
Imports	[1] 7.4	[6] 5-6	[14] 12.6		

[1] National Foreign Assessment Center, CIA, "China: Economic Indicators," ER77-10508, October 1977.

[2] Breakdown of value for GNP in 1975 into values for output in agriculture, industry and services obtained as follows: Value of GNP in 1970 (from source in footnote 1, above) used to determine value of output in agriculture and industry in 1970 on basis of shares of those sectors in GNP in 1970; these shares (0.32 for agriculture and 0.48 for industry) from Dwight H. Perkins, "Issues in the Estimation of China's National Product," in Alexander Eckstein, "Quantitative Measures of China's Economic Output," University of Michigan Press, forthcoming. The value for output in agriculture and industry in 1970 are projected forward to 1975 by means of the index of output in these sectors, 1970–75, in source in footnote 1, above. The value of output in the service sector in 1975 is the residual.

[3] Value of output in industry in 1970, estimated by means described in footnote 2, above, is distributed to the consumers goods and producers goods sector on basis of share of those sectors in total industrial output in 1970; these shares (0.56 for producers goods and 0.44 for consumers goods) from Robert Michael Field, "Civilian Industrial Production in the People's Republic of China, 1949–74, "in previous Joint Economic Committee compendium of papers on China's economy, "China: A Reassessment of the Economy, 1975. "The values for output in the consumers goods and producers goods industries in 1970 are projected forward to 1975 by means of the index of output in these sectors, 1970–75, in source one above.

[4] Per capita consumption assumed to be 60 percent of per capita GNP. See Alexander Eckstein, "The Chinese Development Model," this volume. Ecksteim makes this assumption for 1974.

[5] Derived on basis of estimates for absolute values for 1975 and 1985 in col. 1 and 3, respectively.

[6] See text.

[7] Value of output in services sector assumed to grow an annual rate of growth equal to the average of the annual rate of growth of population and output in industry.

[8] Sum of values for agriculture, industry, and services.

[9] Absolute level in 1975 projected forward at an annual rate of growth of 2.5 percent.

[10] Sum of values for consumers goods and producers goods industries.

[11] Absolute level in 1975 projected forward at an annual rate of growth of 6.5 percent.

[12] Absolute value in 1975 projected forward at an annual rate of growth of 9.5 percent.

[13] "Intermediate" model estimate for population in 1985 in John Aird, "Demographic Change in the PRC," this volume.

[14] Absolute value in 1975 projected forward at an annual rate of growth of 5.5 percent.

[15] Derived on basis of estimates for absolute values for 1975 and 1985 in col. 1 and 5, respectively.

[16] Rates of growth for 1978–85 presented in Hua Kuo-feng's speech to the Fifth National People's Congress, Feb. 26, 1978. (Peking Review, No. 10, Mar. 10, 1978.) The rate of growth for industry was to be over 10 percent.

[17] Absolute value in 1975 projected forward at an annual rate of growth of 4.5 percent.

[18] Absolute value in 1975 projected forward at an annual rate of growth of 10.5 percent.

According to our "pessimistic" forecast, the Chinese should be able to achieve a sustained rate of growth in the decade between the mid-1970's and mid-1980's of 6.5 percent, China's GNP in the mid-1980's being almost double the present level and approximately one-fourth greater than that of Japan in 1975. Per capita GNP will grow at a rate of almost 5 percent a year, exceeding 500 United States 1976 dollars by the mid-1980's, equivalent to two-thirds that of Taiwan in 1975. Equally significant, per capita consumption should increase by more than 50 percent over this period, assuming the rate of investment were to remain stable. The relatively high growth rates in industry compared to those in agriculture means the radical shift in the structure of the economy over the previous 25 years will continue; industry accounting almost two-thirds, agriculture for only one-fifth of China's

GNP in 1985. Finally, and most important, this successful program of industrialization will be obtained while the Chinese maintain their present policy in regard to self dependency, that is, no large-scale, long-term borrowing from abroad.[54]

This forecast, of course, is nothing but a reflection of the several crucial assumptions made in its derivation, but it is important to note that the forecast is labeled a "pessimistic" one because of these assumptions. The results, however, as indicated above, depict a rather satisfactory result of the Chinese leaderships efforts over the next several years. Furthermore, while our results are more "pessimistic" than those presented by Hua in his "optimistic" speech to the Fifth National People's Congress the difference is not all that great; Hua's forecasts yielding an overall annual rate of growth approximately 2 percentage points higher or a level of economic output in 1985 that is approximately 20 percent higher than our forecast. Although the most significant difference between the two forecasts is in the agricultural sector, Hua's target rate of growth almost twice as large as that in our forecast, the resulting structure of the economy in 1985 is almost identical in both forecasts.

The principal distinction between these two forecasts, that is, what lies behind the different results, is between our more "pessimistic" and Hua's (and the Chinese planners) more "optimistic" assumptions regarding three crucial parameters of these forecasts: Production possibilities, the rate and allocation of investment, and the policy of self-dependency. The relatively slow growth of agriculture and the reductions in the relatively high growth rates in industry included in our forecast are derived, in part, from the assumption of a downward trend in input productivity in the future compared to their levels in the past 25 years, that is, based on the "law" of diminishing returns.

The Chinese, on the other hand, expect to experience rapid shifts outward in the production possibilities frontier due to rapid innovations. The assumption we make in our forecast, we believe, is more solidly grounded in both economic reasoning and historical evidence, not only for China but for other economies as well. The two forecasts are both related to relatively short period of time and the considerable time lag and investment required for the spread and implementation of innovations that would be necessary would appear to rule out any short-run or sudden change in the quantitative relationships between inputs and outputs for an entire sector. Furthermore, the relative neglect by the Chinese of the basic research and development efforts that lead to these innovations for achieving higher input productivity has led to a significant shortage of middle-level technicians and engineers for effectively implementing the "borrowed" or imported innovations from abroad, also arguing against any sudden technological transformation of China's economy.

In industry, the new leadership obviously hopes to achieve the rapid outward shift in production possibilities by means of significant additions to their capital stock: 120 large-scale producers goods industrial and transportation projects in the development of 14 industrial bases.

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[54] As the reader will note, the forecasts for exports and imports in table 1, because they were both assumed to grow at the same rate in 1975-85, include the continuation of a slight import surplus in commodity trade. The magnitude of the import surplus, however, could readily be financed by Chinese receipts in the noncommodity trade catagories in the balance of payments and short-term commercial credits which were utliized by the Chinese in 1975 for this purpose.

Our forecast, however, is derived on the bases of the assumption the Chinese will do well to maintain the existing rate of investment and the share of that investment going to the producers goods industries. Hua's targets and his discussion of these industrial and transportation projects, on the other hand, implicitly indicate not only a significant increase in the rate of investment, but an equally significant reallocation of that investment in favor of the producers goods industries. While China's political and economic system would allow China's new leadership to increase the rate of investment and allocate that investment according to the planners priorities; their doing so to develop the 120 projects mentioned by Hua would seriously call into question his forecast's predictions concerning the relatively high rate of growth in the agricultural sector and the relatively high rate of growth we have included with his forecast for per capita consumption. Finally, even if the Chinese are able to achieve the implied high rates of investment and its reallocation in favor of heavy industry, the size and nature of these industrial and transportation projects would make it somewhat doubtful the major portion of them could be completed and brought into production at an efficient level of operation by 1985; that is, their contribution to increased input productivity and total output could be included in the output targets presented by Hua.

Perhaps the most significant difference in assumptions behind the two sets of forecasts presented in table 1 concern China's policy of self-dependency. Our "pessimistic" forecast reflect the serious constraints placed on China's economic development over the next 7 years by the relatively slow growth in agricultural production (2 to 3 percent) which results in a relatively slow rate of growth in exports (5 to 6 percent), and an unwillingness to engage in large-scale, long-term foreign borrowing. The continuation of this policy would, therefore, seriously limit the expansion of China's imports over the next 7 years; that is, seriously constrain the rate of investment and rate of growth of industrial production and/or increases in the standard of living of the labor force. As is indicated in table 1, Hua's speech does not include any quantitative forecast for the foreign trade sector, only stating "there should be a big increase in foreign trade." Given the resource constraints emphasized in our "pessimistic" forecast, not only will the achievement of the targets presented by Hua require a very rapid increase in the level of imports, but an obvious need to rely on a significant volume of long-run foreign loans for financing those imports.

EMERGING POLICY CHOICES OF THE NEW LEADERSHIP [55]

The need for sizable, long-term foreign loans—that is, as a necessary but not a sufficient condition, for the realization of the investment program and output targets presented by Hua in his speech to the Fifth National People's Congress in February—is not based solely on the magnitude of that investment program or the output targets themselves. As a result of the large number of nationwide conferences held in 1977 and 1978 to discuss the many economic policy problems facing the new leadership and the many articles and press releases which have come out of China over the past year, the economic policy and strategy choices of the new leadership in several key areas have been made clear. These choices offer even greater evidence for the argument that China's program of economic modernization under the new leadership must rely on extensive borrowing from abroad if it is to succeed.

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[55] A parallel and more detailed discussion of the economic policies actually being adopted by the new leadership since Mao's death, as well as the policies which will be made necessary both by the economic plan for 1985 and the objective of achieving China's economic modernization by the end of the century is presented in Nai-Ruenn Chen, "Self-Reliance vs. Learning from Abroad: China's Path to Economic Modernization," this volume.

Self-Reliance

Neither Hua's speech, nor the reports in the Chinese press, explicitly refer to a recognition of this need to abandon China's longstanding policy of self reliance in regard to foreign loans; a policy so entrenched over the past two decades that it almost can be designated as an ideological principle. Yet, Hua's speech did mark a major step in that direction. This major speech by the leader of the party and the Government, devoted largely to the new program for the modernization of China's economy, makes no mention of the principle of self-reliance. This aspect of Hua's speech is very important as it is one of the most explicit indicators that the arrest of the Gang-of-Four was not just another in the series of periodic swings in the pendulum since 1949 as a result of the continuous political infighting for positions of power. Rather, it represents the extent to which the moderate-pragmatic approach to China's economic development problems has emerged victorious over the radical opposition, that is, Mao's development strategy, in the two-line struggle of the entire past 28 years. Political infighting among groups and individuals for positions of power obviously will continue and some observers have already begun to speculate about a possible confrontation between Hua Kuo-feng and Teng Hsiao-ping. As far as economic policy is concerned, however, the overwhelming victory of the moderates-pragmatists in the two-line struggle becomes cleared with each new speech and press release.[56]

Although they have not yet publicly abandoned the policy of self-reliance in regard to long-term foreign borrowing, one of the first and most explicit decisions of the new leadership was the abandonment of the policy of self-reliance in regard to the import of foreign technology and producers goods. This step is not surprising inasmuch as the debate over China's reliance on these imports had been a key issue in the two-line struggle in economic policy. This is especially true after 1969 when China's dependence on imports, reduced to a remarkably low level as a result of the Cultural Revolution, increased significantly under the influence of Chou En-lai and the core of moderate-pragmatic leaders, including Teng Hsiao-ping, who were rehabilitated under his guardianship.[57] The ensuing very rapid increase in the level of imports (chemical fertilizer, foodstuffs, machinery and equipment, and complete plants) was compounded by the unexpected rise in prices in the West, creating a serious balance-of-payments problem for the Chinese in 1974.[58] These developments in the balance of payments, the changes in Sino-American relations which saw the United States soon become one of China's major trading partners, and the suggestion by Teng Hsiao-ping that the growing level of imports be financed by increased exports of Chinas' raw materials, including petroleum, played a significant role in the downfall of the rehabilitated moderate-pragmatic leadership in 1975.

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[56] To indicate the extent to which the victory of the moderate-pragmatic economic policies has been made complete, students applying to graduate school have been informed the questions concerning politics on the qualifying exams will cover Marxism-Leninism, political economy (that is, the labor theory of value), and the two-line struggle. There is no mention of the Thoughts of Mao. Another example is the list of topics to be investigated by the new economics section of the Academy of Science, all of which take up issues which Marxism-Leninism fails to answer, but which Mao provided answers for during the last 15 years of his life.

[57] See the discussion of the changes in China's foreign-trade in the late 1960's and early 1970's which reflected outcomes of the two-line struggle over foreign trade policy during this period in Robert F. Dernberger, "Economic Development and Modernization in Contemporary China: The Attempt to Limit Dependence on the Transfer of Modern Industrial Technology from Abroad and to Control Its Corruption of the Maoist Social Revolution," in Frederic J. Fleron, Jr., ed., "Technology and Communist Culture," Praeger, New York, 1977, pp. 224-264.

Following Mao's death and the purge of the radicalsm for positions of power, however, the restored moderate-pragmatic leadership did not take long in their open advocacy of abandoning a policy of self-reliance in the modernization of China's existing industrial capacity and in the rapid expansion of that capacity. Numerous sector-by-sector reviews and critical appraisals of the backwardness of the level of technology in China's industry placed the blame squarely on the radicals' implementation of the policy of self reliance. The means for correcting this situation and for attaining the most advanced levels of productivity and output in the industrialized countries by the end of the century was also made explicit; it would be necessary for the Chinese to rely heavily on imports of technology and machinery and equipment from abroad. The long-run objective, of course, remains the same—a self-dependent modern economy.[59] But in the short run or over the foreseeable future, China's rate of foreign trade dependency can be expected to revert to the norms of the 1950's when the import of foreign technology and producers goods, including complete plants, represented one of the most intensive periods of technology transfer in the history of industrialization.

Given the size of China's economy, its relatively rich resource endowment, and the industrial base already developed over the past 28 years, the above arguments do not predict the Chinese will rely on imports to supply 40 percent of their investment in machinery and equipment as was true in the 1950's. On the other hand, their import dependency will obviously be significantly higher than the approximately 10-percent level experienced as a result of the self-reliance policies of the 1960's. No precise estimate can be made until more is learned concerning the exact levels and structure of the investment and output targets of the long-run economic plan for 1975–1985. Nonetheless, China's imports over the next 7 years should increase at a considerably faster rate than the 5- to 6-percent estimate included in the pessimistic estimates in table 1, which assumes imports will be financed from export earnings and the Chinese will not engage in long-term foreign borrowing, if the Chinese hope to be able to achieve the investment and output targets presented by Hua. They should increase considerably faster, not merely because of the very significant increases in investment and output in Hua's speech compared to those presented in our pessimistic estimates in table 1, but also due to the new leaderships' decision to rely to a much greater extent than in the past on imports for the realization of their investment and production plans.

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[58] For further details of these changes in China's foreign trade, see Rich Batsavage and John Davie, "China's International Trade and Finance," in this volume.

[59] For a review of the level of technology embodied in the existing capital stock in Chinese industries, on a sector by sector basis, see John B. Craig and James M. Lewek, "The Chinese Machine Building Industry," in this volume.

Standard of Living

Other policy decisions by the new leadership will add even more pressure for rapid increases in the level of imports and the need to finance a portion of those imports by long-term loans. For example, it is becoming increasingly clear that the new leaderships' pledge to increase the standard of living means much more than the mere repetition of a long-run objective. Although they still refer to the importance of moral and normative incentives, much greater emphasis is being given to the implementation of a material incentive system which will elicit greater labor effort and productivity from the labor force, another key issue debated in the two-line struggle over economic policy in the past. The reference in Hua's speech to the need to provide for an increase in income for 90 percent of the rural labor force in normal years and the incentive systems being discussed also suggest these increases in income are to be more widespread and continuous, than the one-time increase in wages for those industrial workers in the lower wage scales in 1977 to offset worker discontent.

The particular bonus and piece rate systems being discussed in the Chinese press are obviously intended to serve as examples of the types of systems being considered and to show how those systems have indeed led to increased productivity in the particular mines, factories, and communes that have introduced them. Yet, although the particular system to be advocated may not have been decided upon, all of the examples being discussed in the press share a common feature: the workers share in the increase in productivity and output that results. If the resulting increases in productivity and output are large enough, of course, those increases can provide for a significant increase in the standard of living for the labor force and in the level of investment in industry. On the other hand, increased productivity and output in the mining and producers goods industries do not provide those products which contribute to a higher standard of living for the labor force. Public consumption (health services, education, transportation, housing, et cetera) and industrially produced consumers goods (bicycles, sewing machines, radios, watches, et cetera) will continue to increase their share of total consumption. If the material incentive system is to be meaningful, however, significant increases in the supply of foodstuffs and industrially process agricultural products (textiles) must be made available for consumption. Not only have these commodities been rationed at relatively stable per capita levels since the mid-1950's, but the arguments for believing the Chinese will be unable to achieve their planned rate of growth of between 4 and 5 percent in agricultural production have been presented earlier in this paper.

Thus, the success of their decision to reply on a material incentive system for obtaining increased labor effort and productivity will ultimately depend on the success the new leadership has in achieving their output targets in agriculture. The attempt to achieve those targets, of course, will rely—to some extent, at least—on the continued and growing level of imports of current inputs, that is, chemical fertilizer, and producers goods, that is, agricultural machinery, for the agricultural sector.[60] Equally important, however, and more relevant to our argument in this section of the paper, if the rations of basic foodstuffs and textiles are increased so as to make the new material incentive systems more effective (the Chinese labor force already has considerable money savings which cannot be used to buy more food or textiles) and the rate of growth in agriculture turns out to be nearer our pessimistic forecast of 2 to 3 percent than Hua's optimistic 4 to 5 percent, the large-scale imports of agricultural products of the past should continue and perhaps increase somewhat in the future. Although there is no reason to believe these imports will grow as rapidly as the other catagories of imports, such as producers goods, they could increase rapidly during 1 or 2 years of poor agricultural production, which, given the history of Chinese agriculture over the past several centuries up to the very present, is likely to happen sometime during the next decade.

Modernization of the Military

Reliance of modern, sophisticated weapon systems or a manpower intensive, people's milita for China's military strategy was a third major policy issue in the two line struggle over the past two decades-Mao and the radical leaders were openly critical of those who desired to rely on modern weapons systems, arguing that modern weapons systems were orientated to offensive military operations, whereas China's needs and objectives were primarily defense which could best rely on China's greatest asset and strength, the Chinese people. A review of China's military strategy and operations over the past 28 years does, in fact, suggest the defensive orientation of China's military; the radicals often being the dominant force in the two-line struggle within China's military, frequently succeeding in purging those leaders who openly argued for the modernization and professionalization of China's military. Nonetheless, given their experiences in China's military engagements over the past 28 years and the obvious military capabilities of their potential adversaries, China's present military leaders must certainly appreciate the role modern weapons systems will play in determining the outcome of armed conflict with those adversaries in the near future.

This appreciation would explain the crucial role played by the military in assuring the rapid transition following Mao's death which saw the elimination of the radical leaders in favor of the moderate-pragmatic leadership without an open armed conflict or civil war. In fact, the military undoubtedly is the most politically powerful interest group which will support the economic plans and policies of the new leadership. The reason for this is clear, for the modernization of China's military is directly linked with the modernization of China's economy—especially the development of China's technical and scientific capabilities, the achievement of greater productivity and quality control, and the expansion of such key industries as metals (high-grade metals and alloys), machine building (modern military equipment and armaments), chemicals, fuels, and transportation. To this extent, the economic objectives of the military and the new leadership are identical; it is in the choice of alternative allocations of this expanded productive capacity that problems may arise, that is, whether that output should be devoted to increase the supply of producers goods for investment projects and the further expansion of China's industrial capacity or be allocated to the military as an unproductive end user.

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[60] The first foreign industrial exhibition of agricultural machinery is to be held in Peking later this year: First proposed by the Japanese, the proposal was promptly accepted by the Chinese and most of the Western industrial countries, excluding the United States, have been invited to participate.

As with the previous two key issues in the two-line struggle, the decision of the new leadership in regard to China's future military strategy also has become clear. Whether forced to accept the wishes of the military because of the latter's political power, deciding to because of the debt owed to the military for its support during the period of transition, or merely because of an identity of their priorities; the new leadership has decided to undertake the modernization of China's military. Exactly how this is to be done, however, is much less clear.

Whatever the exact nature of their military modernization program, it is bound to include the increased procurement of the conventional and advanced weapons and equipment which can be provided by the scientific and technological capabilities and industrial production capacity the Chinese acquire over the next 7 years as a result of their programs and policies for the modernization of China's economy. As stated by Hua in his speech to the Fifth National People's Congress, "the national defense industries should put their production to good account, diligently carry out research and trial production and then the production of more and better modern conventional and strategic weapons." Yet, given China's current capabilities and the pace at which their scientific and technological capabilities and industrial capacity can catch up with the most advanced level of the industrial nations of the West over the next decade, the modernization of China's military during that period must rely on a considerable import of weapons, armaments, equipment, and component parts. This reasoning is reflected in the visit to Western Europe of a Chinese military delegation which held discussions with their counterparts in the West concerning the availability of these potential imports.

The outcome of these discussions and decisions is yet to be revealed. On the one hand, the system of trade controls created during the cold war still remains and places restrictions on the export to China of strategic materials and equipment which have possible military uses, a problem which may prove to be a serious obstacle to these imports inasmuch as the Chinese undoubtedly will be interested in the most advanced weapons systems and equipment available. On the other hand, given their other import needs, the extent to which the Chinese will be willing to devote their available foreign exchange for this "nonproductive" purpose is also unknown.

The argument here, however, does not rely on knowing what weapons systems and equipment and how much will be imported, only that China's new leadership has decided to modernize China's military and this will require the import of military weapons and equipment. This modernization program, of course, will also divert domestic resources and output from the investment and industrial expansion program spelled out in Hua's speech. In addition, these military weapons and equipment imports will lead to an even greater rate of increase in the level of imports than is already indicated on the basis of the investment and production targets announced in Hua's speech and the policy decisions of the new leadership calling for greater reliance on imports of technology and commodities for the realization of those targets and calling for an increase in the standard of living of the labor force.

Foreign Loans

As mentioned earlier, Hua's speech does not include any explicit indication of a reversal of the policy of self-reliance in regard to foreign borrowing to finance the modernization of China's economy. Nor does his speech offer any clues as to the probable rate of increase in exports and imports in the long-run economic plan, 1975–85. Hua only states that "there should be a big increase in foreign trade." This is the reason why no entries are included for the foreign trade sector under "Hua's 'Optimistic' Forecast" in table 1. The section of Hua's speech devoted to foreign trade is not only very brief, it excludes any mention of imports. Rather, it emphasizes the need for the creation of a "number of bases" for supplying export products and the need to increase the share of industrial and mineral products in the expansion of exports that will be required.

On the basis on the above arguments, however, there is every reason to believe that the new leaderships' attempt to achieve the other targets in Hua's "optimistic" forecast presented in table 1, while also relying more heavily on imports of technology and producers goods in the expansion of industrial capacity than in the past two decades, attempting to rely on a material incentive system to achieve greater labor effort and increased labor productivity, and modernizing China's military, will result in a significantly more rapid rate of increase in imports and a higher foreign trade dependency ratio than is depicted in the "pessimistic" forecast in table 1 (5 to 6 percent and 4 to 5 percent, respectively). No accurate estimate of the probable rates of change in imports and exports which should be included in the foreign trade sector for Hua's "optimistic" forecast have been made. The following simple calculations are presented merely to suggest the nature of the balance of payments problems China's new leadership is likely to encounter as they attempt to achieve the plan targets they have adopted and the new policy decisions they have made, that is, the need to engage in long-term borrowing from abroad.

For example, if the rate of increase in the level of imports were to be twice that in our "pessimistic" forecast, that is, 10 to 12 percent, instead of 5 to 6 percent, and, assuming the Chinese are able to achieve the target for the rate of increase in agricultural production in Hua's "optimistic" forecast, the rate of increase in the level of exports were raised from the 5 to 6 percent in our "pessimistic" forecast to 8 to 9 percent (our estimate for the rate of increase in GNP implied by the long-run economic plan), China's foreign trade dependency ratio would be increased by a mere one percentage point, that is, from 4 to 5 percent in 1975 to 5 to 6 percent in 1985. Thus, although these assumptions and results are in keeping with the arguments presented above and would not appear to be unrealistic, they would also appear to be rather conservative. In addition, although presented only as an illustration of our argument and not as a prediction of what will actually occur over the next 7 years, they do illustrate the nature of the problem the new leadership is likely to encounter during that period very well. Even these rather conservative assumptions, which only increase China's foreign trade dependency ratio by one percentage point, still yield a cumulative import surplus of more than 25 billion U.S. dollars over the next 7 years. Quite simply, if the new leadership implements the economic plans and policies described above, they will soon generate a sizable import surplus.

This projected import surplus, of course, need not be financed by means of long-term foreign loans. Before reaching the conclusion that they must rely on foreign loans for that purpose, it is necessary to show the new leadership would encounter serious difficulties in attempting to finance the projected imports surplus by other means. The first alternative source would be China's foreign exchange reserves, estimated to have been between 1 and 4 billion U.S. dollars in the early 1970's; that is, before the large import surpluses of the mid-1970's.[61] The import surplus in the mid-1970's was financed partially by means of these reserves and, in part, by normal, commercial credit of 5 years or less. Presumably the sizable export surpluses China built up in 1976 and 1977 were used to repay these short-term commercial loans and to rebuild China's foreign exchange reserves. Some of these reserves could be used to finance the projected future import surpluses, but the need to make payments on the short-term credits used to finance China's imports of complete plants purchased from the West as of the end of 1974 will continue through 1982, and, if our projections of future imports are correct, China will require 5 billion U.S. dollars of foreign exchange reserves to maintain enough reserve, to have 3 months' cover for financing imports. It should be obvious, therefore, that while the available reserves may provide some financing for the projected future import surplus it will not be a sufficient source for the financing required.

A second possible source are the noncommodity receipts in China's balance of payments: Remittances from overseas Chinese to their relatives in China, expenditures of tourists in China, shipping and insurance services provided by the Chinese for their commodity trade, et cetera. Remittances from overseas Chinese, the largest items in this category, are estimated to have been approximately $100 million a year during the early 1970's[62] and, despite the recent change in policy which now encourages tourism in China, it is unlikely this source of foreign exchange earnings will exceed 250 million U.S. dollars in any 1 year in the near future; that is, will be a significant means for financing the projective sizable surplus of imports over the next 7 years.

The most obvious potential means for financing the projected gowth in imports would be an equivalent increase in exports. One of the basic themes of the arguments in this paper, however, is the difficulty the Chinese will have in attempting to achieve a rate of growth in exports faster than that included in our "pessimistic" forecast in table 1 (that is, the problems they will encounter in achieving rapid rates of growth in agricultural production and the rapid rates of growth in the domestic demand for that output due to the rapid expansion of industrial production, the industrial labor force, and the desired increase in the standard of living). Thus, our estimate for the potential growth in exports is based on the relatively stable relationship established between the rate of growth in exports and the rate of growth in domestic agricultural and industrial production over the past 28 years.[63] Furthermore, our simplified numerical illustration of why the economic plans and policies of the new leadership can be expected to require sizable borrowing abroad over the next 7 years, accepts Hua's "optimistic" forecast for increases in agricultural production and adjusts our estimate for the rate of increase in exports upward by over 50 percent.

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[61] See David L. Denny, "International Finance in the People's Republic of China," in the previous Joint Economic Committee compendium of papers on China's economy, "China: A Reassessment of the Economy," 1975, and Rich Batsavage and John Davie, "China's International Trade and Finance," in this volume.

[62] See A. H. Usack and R. E. Batsavage, "The International Trade of the People's Republic of China," in the 1972 Joint Economic Committee compendium of papers on China's economy, "People's Republic of China: An Economic Assessment."

Nonetheless, the stable relationship of the past between exports and domestic agricultural and industrial production could be changed by a significant shift in favor of greater exports of China's raw materials, such as petroleum. There is reason for being cautious in this regard, however. Given the economic plans and policies of the new leadership, the domestic demand for these raw materials should rise relatively rapidly over the next 7 years. This is especially true for oil, inasmuch as the Chinese undoubtedly will continue the shift to a greater reliance on the use of oil, diesel fuel, and gasoline as a source of energy.[64] Because of this increasing demand, one estimate holds that even under the most favorable assumptions, China will be able to export annually over the next decade or so no more than one-tenth of the oil exported by OPEC in 1974; according to that study, a more reasonable estimate would be about one-twentieth.[65] In fact, given the magnitudes of China's industrialization program and the emphasis given to the development of an extensive and well-developed transportation network, China's reliance on exports of oil as a major source of foreign exchange could even diminish over the next 7 years as domestic demand overtook the available supply.

On the supply side, growth rates of 20 to 25 percent in China's oil industry will be very difficult to maintain over the next 7 years.[66] The attempt to tap China's oil reserves, both onshore and offshore, to maintain these past rates of growth will require drilling technology and equipment and the means for transporting the petroleum from the drill head to either the domestic user or the ocean ports (which also require facilities for loading oil tankers) which the Chinese have not yet acquired. Even if the technology, equipment, and skilled workers were to be obtained from abroad, adding to the demand for imports, these items are in scarce supply and would involve high costs, considerable timelags, and possibly the direct participation of foreign companies in China's development program.

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[63] This estimate of China's export potential is consistent with the estimates of Hedija Kravalis in "China's Export Potential," in this volume.

[64] Between 1970 and 1974, oil increased its share in China's total energy supply from 14 to 22 percent.

[65] CIA, "China: Energy Balance Projections," A(ER)75-75, November 1975.

[66] See Vaclav Smil, "Energy Production," and Kung-ping Wang, "Mineral Output and Productivity," in this volume.

Despite these words of caution, however, the exploitation of China's oil resources does provide the Chinese with an excellent export commodity—liquid gold—that is in great demand in those very countries that can supply the Chinese with the imports they will need in the next 7 years, that is, Japan and Western Europe. On the other hand, although these potential exports of raw materials may help alleviate some of China's balance-of-payment problems, they will not provide the magnitude of foreign exchange earnings required for financing the import surplus implied by the economic plans and policies of the new leadership.

One final source for financing the projected import surplus, of course, is the continuation of the present practice of relying on short-term commercial (5 years or less) credit for individual import transactions, that is, a certain amount paid when the imports are received by China and the rest of the payments spread out periodically over the next few years.[67] This source, however, can only be a temporary means for financing the projected growth in the gap between current imports and current exports implied in the economic plans and policies of the new leadership. In other words, the short-term debt would soon accumulate to the point where current exports could not cover the repayments scheduled by the debts used to finance imports in previous years and the Chinese would have to engage in long-term foreign borrowing for that purpose.

We cannot, of course, rule out the use of each of the above sources combined to finance a growing Chinese import surplus or the limitation of that import growth to the level made possible by these sources. Quite simply, actual events may see the Chinese leadership adapt their economic plans and policies in light of the constraints imposed by domestic resource and foreign exchange availability; constraints presently dictated by their policy of self-reliance in regard to foreign borrowing. Such a policy would merely mean the actual evolution of the economy over the next 7 years would be closer to our "pessimistic" forecast in table 1 (a forecast based on the assumption of a policy of self-reliance in regard to foreign borrowing) than to the forecast presented in Hua's speech. On the other hand, if the new leadership does attempt to realize its economic plans and policies, that is, the results presented as Hua's "optimistic" forecast in table 1, over the next 7 years, we conclude the only possible way those plans and policies can be realized is by means of China's obtaining long-term foreign loans.

The Choice of Trading Partners

While no attempt is made here to estimate the magnitude of China's potential long-term borrowing from abroad, those loans undoubtedly will be tied to the financing of particular large-scale import transactions negotiated with groups of Western businessmen or countries. These large-scale import transactions will be an important feature of the projected rapid growth of imports, that is, those imports specifically obtained for the purpose of achieving the new leaderships plans for rapidly increasing China's technological capabilities and developing China's industrial capacity so as to catch up with the West by the end of the century. Thus, the source of these long-term loans will be determined by the trading partners the Chinese rely upon for the purchase of these imports [68]

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[67] For a detailed description of the short-term financing used to finance China's imports, see David L. Denny, "International Finance in the People's Republic of China," in previous Joint Economic Committee compendium of papers on China's economy, "China: A Reassessment of the Economy," 1975.

The Soviet Union was a major supplier of these producers goods during the 1950's, when China was rehabilitating and expanding basic industries which did not require the most sophisticated and advanced technology. Now and in the future, the Chinese will be able to produce these producers goods domestically; requiring instead producers goods which embody more advanced technology. The socialist countries, although able to meet some of China's technological needs in this regard, are themselves currently seeking imports of high-technology producers goods in the West. The comparative advantages of Western suppliers is even greater in China's import needs for current inputs in agricultural production, that is chemical fertilizer, and for agricultural products.

Transport costs for trade with the socialist countries are also relatively high, especially when compared with the transport costs for trade with Japan, China's largest trading partner. In addition, China's export commodities probably accommodate Japan's needs more than they do the needs of any other industralized country. As for China's import needs, Japan's export potential, current economic conditions, continuing accumulation of foreign exchange reserves, and the facility with which the Japanese transferred official recognition from the Republic of China to the People's Republic of China will all serve to insure that Japan will remain the major supplier of the technology, producers goods, and long-term loans required for the implementation of the new Chinese leaderships economic plans and policies.[69]

Although Japan's dominance of China's import trade should continue and even increase over the next 7 years, the Chinese also can be expected to follow a policy of diversifying their foreign trade ties so as to avoid exclusive dependence on any single country or group of countries. This will lead China to develop trade ties with all countries and areas: the socialist countries (including the Soviet Union), the industrailized countries of North America and Western Europe, agricultural surplus countries in South America and Southeast Asia, and raw material suppliers among the ranks of the underdeveloped countries. This policy will also help to insure some role for the United States in China's growing import trade.

As far as Sino-American trade ties over the next 7 years are concerned however, the United States will probably remain—as at the present time—the source of particular types of advanced technology and producers goods the Chinese cannot obtain from U.S. licensed firms in third countries and residual supplies of agricultural products during peak periods of Chinese demand for these products. Several major obstacles will prevent the United States from playing a major role, that is, compared with Japan and Western Europe, in the projected rapid growth in Chinese imports over the next 7 years. Foremost among these obstacles—mostly political—are the following: (a) Considerations which make it very difficult for the United States—unlike any other major industrial country—to grant de jure recognition to the People's Republic of China and withdraw that recognition from the Republic of China; (b) considerations which have made it difficult for the United States to settle the issue of Chinese frozen assets in this country and American claims on assets and debts in China; (c) the considerations which have made it difficult for the United States to grant "most-favored-nation" tariff rights to Chinese exports in the normalization of commercial relations; (d) the system of legal controls in the United States on commercial trade with China; and (e) the difficulty which can be expected in any future attempt to remove U.S. controls on the extension of long-term credit for financing exports to China.[70] None of these "difficulties" are insurmountable, but little or no progress has been made in solving them since the early 1970's and, as long as they remain, the United States will undoubtedly continue to follow Japan and then Western Europe as the major contributors to China's rapidly growing import trade over the next 7 years.

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[68] An example of this phenonemon is the long-term trade agreement signed by the President of the Japan-China Economic Association (Japan) and China's Vice Minister for Foreign Trade in February. The agreement calls for 10 billion U.S. dollars in exports by each country to the other over the next 5 years; Japan to export 7 to 8 billion U.S. dollars of plants and technology and 2 to 3 billion U.S. dollars in construction materials, China to export 47 million tons of oil, 5 million tons of coking coal for steelmaking, and 3.5 to 4 million tons of steaming coal for power generation. Thus, basically the agreement would appear to be a barter agreement, but the Japanese exports of plant and technology will be made on a deferred payment bases. These are not to be paid for on the basis of long-term loans, presumably out of deference to China's ideological opposition to long-term borrowing from abroad. Nonetheless, at the same time, the Japanese are said to have adopted two means for providing what amounts to long-term loans for financing China's growing imports from Japan: making sizable foreign-currency deposits with the Bank of China which the Chinese can utilized to pay for Japanese exports and the extension of credit by Japanese banking system and Import-Export Bank directly to Japanese exporters engaged in export trade with China.

[69] See footnote, 68, above.

CONCLUSION

The discussion and arguments in this paper, as in a good many of the other papers in this volume, has emphasized the serious economic problems the new leadership faces in its attempt to modernize China's economy, and reach the front ranks of the industrialized world by the end of this century. Other papers in this volume present analyses and conclusions which are significantly more optimistic about China's economic future. Even those which emphasize the economic problems in China's future, such as this paper, also include arguments which would lead to a rather favorable interpretation of China's past record of economic development and possibilities for continued growth in the future, although nowhere near as optimistic as the prospects held forth in Hua's speech to the Fifth National People's Congress.

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[70] For a detailed discussion of these considerations which lead to these difficulties and of the difficulties which serve as obstacles to greater Sino-American trade, see Eugene A. Theroux, "Legal and Practical Problems in the China Trade," in the previous Joint Economic Committee compendium of papers on China's economy, "China: A Reassessment of the Economy," 1975, and Martha Avery and William Clark, "Sino-American Commercial Relations" and Stanley Lubman, "Legal Aspects of PRC Trade," in this volume. Two papers in this volume attempt to estimate the effect the granting of most-favored-nation tariff privileges to China's exports would have on Sino-American trade; see James Kilpatrick and Phillip Lincoln, "MFN and the China Trade," and Helen Raffel, "Tariff Restrictions and PRC Export Potential," in this volume. It should be noted that most of the papers in this volume deal with topics central to the economic problems and potential of China's economic development as would be viewed from within China itself; the papers in this volume referred to in this footnote are included because of the great concern with these problems of Sino-American trade by the American public and Government and these latter problems, especially MFN, are not nearly as crucial in determining China's economic future as they are in determining the future political relations between these two countries. For a discussion of the problems which are preventing the introduction of the necessary means of providing long-term financing of U.S. exports to China, see Frank Ching, "Rough Going Forecast for U.S. Proposals To Allow China Loans," The Asian Wall Street Journal, April 14, 1978.

For example, all of the papers in this volume recognize the record of positive rates of growth in both agriculture and industry in China's economic development over the past 28 years, which have created a significant economic base for the new leadership to build on in their attempt to modernize China's economy. More important, all recognize the tremendous potential for future growth and even the more pessimistic of the papers that follow believe the new leadership's economic plans and policies will achieve a considerable degree of success; that is, further increases in GNP per capita. Perhaps most important of all is that these economic plans and policies of the new leadership indicate domestic economic rationality and stability and a far greater reliance on normal commercial relations with the industrialized countries of the non-Communist world than was true in the past.

RECENT CHINESE ECONOMIC PERFORMANCE AND PROSPECTS FOR THE TEN-YEAR PLAN

By Nicholas R. Lardy*

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In January 1975, Chou En-lai, in a major address to China's Fourth National People's Congress, called for the "comprehensive modernization of agriculture, industry, national defense, and science and technology before the end of the century." [1] In the 1976–85 decade, China was to build a "relatively comprehensive industrial and economic system" that would serve as the foundation for the more ambitious goals that were to be achieved by the year 2000. Yet, in the 3 years since Chou's speech, China's agricultural output has stagnated, industrial output growth has fallen far below the average rate achieved in the previous decade, and China's foreign trade in real terms remains well below the level of 1974.

These unfavorable developments naturally call into question the very ambitious economic goals contained in the "Outline of the 10-Year Plan for the Development of the National Economy, 1976–85," that were announced to the Fifth National People's Congress by Hua Kuo-feng in February 1978.[2] The purpose of this paper is to review recent developments in light of China's record of economic development over the past 25 years and to analyze several alternative hypotheses that may explain the relatively poor economic performance over the past few years. This analysis highlights the critical problems that Chinese economic planners face in industry, agriculture, and foreign trade and then assesses, on the basis of currently available evidence, the prospects for achieving the goals incorporated in the 10-year plan.

BACKGROUND

In long-term and comparative perspective there are at least three salient characteristics of post-1949 economic development in China: Exceptionally high rates of economic growth, rising rates of capital formation, and extremely modest dependence on foreign financial assistance.

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[1] Chou En-lai, "Report on the Work of the Government," Peking Review No. 4, 1975, p. 23.

[2] Hua Kuo-feng, "Unite and Strive To Build a Modern Powerful Socialist Country," Peking Review, No. 10, 1978, pp. 7–40.

While advocates of the "growth is obsolete" view thrive in the West, the Chinese leadership has always believed that rapid economic growth provides the most effective mechanism to transform China into a modern state and to raise the standard of living of its people. Indeed, China's average annual rate of economic growth between 1952 (the year in which post-civil war economic recovery was basically completed) and 1974 was approximately 6 percent or about 4 percent in per capita terms.[3] At these rates total and per capita output double in 12 and 18 years respectively. Most notably industrial growth under the Communist regime has been extraordinarily rapid, doubling on the average every 6 years.[4] While agricultural growth has been much more modest it has more than kept pace with the growth of population, a remarkable achievement given China's high population density per unit of arable land.

This economic performance is most usefully judged in historical and comparative perspective. Although some other developing countries have grown as fast, only a few have sustained a 6-percent average rate of growth since World War II. China's economic performance is also impressive when it is compared with other large, densely populated Asian countries where per capita incomes were initially (late 1940's) comparable to those of China. In India, for example, another large continental country faced with the difficult problem of raising agricultural output on a relatively fixed quantity of arable land, the average annual rate of per capita economic growth between 1950 and the early 1970's was only 1.1 percent,[5] roughly one-third that of China's. Pakistan has done somewhat better, with a rate of per capita growth slightly over half that achieved by China.

In historical terms as well, post-1949 economic growth has been quite rapid. While there were isolated pockets of economic growth and modernization in China prior to 1949, these were restricted to small foreign-dominated coastal enclaves such as Shanghai and the northeast (Manchuria) that had developed under Japanese occupation and control. The economy as a whole failed to exhibit any sustained growth of per capita output in the half century prior to 1949.[6]

A second notable characteristic of the Chinese economy since 1949 is the unprecedented rate of capital formation (the ratio of gross investment to gross output). Estimated at about 5 percent for the 1930's and much less for the civil war years, it rose to 10 percent by 1952 (the beginning of the first 5-year plan), to 20 percent by 1957 (the end of the first 5-year plan), to 25 percent or more in the early 1970's.[7] These are rates of capital formation which are unusually high for a country of China's low level of economic development. They are, for example, almost twice the rates achieved in India and Pakistan.

This high rate of investment has two important implications. First it is an antidote to the naive view that China's economic development strategy under Mao was concerned primarily with the pursuit of revolutionary ideals rather than economic progress. Clearly, revolutionary ideals have been important, but they have not usually overridden the overwhelming priority accorded to rapid economic growth. Secondly, these high rates of investment imply that the Chinese Government has been successful in deferring wage increases in the industrial sector in favor of reinvesting profits to finance further industrial growth. This, in turn, has important implications that I will pursue below.

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[3] Dwight H. Perkins, "Issues in the Estimation of China's National Product." Harvard Institute of Economic Research Discussion Paper No. 471, April 1976.

[4] Robert Michael Field, "Civilian Industrial Production in the People's Republic of China: 1949–74," in "China: A Reassessment of the Economy," p. 149.

[5] John Mellor, "The New Economics of Growth: A Strategy for India and the Developing World." Ithaca, N.Y.: Cornell University Press.

[6] Dwight H. Perkins, "Growth and Changing Structure of China's 20th Century Economy," in "China's Modern Economy in Historical Perspective," ed. by Dwight Perkins. Stanford, Calif.: Stanford University Press, 1975, pp. 122–123.

[7] Robert Michael Field, "Real Capital Formation in the People's Republic of China: 1952–73," unpublished manuscript, July 1976.

Finally, China's economic development has depended less on foreign financial aid than any other successful developing country since World War II. Even during the 1950's, Soviet loans in aggregate terms were relatively modest—about $1½ to $2 billion over a period of 10 years. Repayments began quickly and by 1955 repayments to the Soviets exceeded new loans. During the decade from 1955 to 1965 the Chinese repaid their loans from the proceeds of their trade surpluses.

At the same time that the Chinese began to repay their debt to the Soviet Union in the mid-1950's, they also initiated their own foreign economic assistance program. Since 1955 they have granted over $7 billion of economic and military aid—a substantial net capital outflow for a country of China's relatively low level of economic development. Of this flow, over half has consisted of economic aid to other less-developed countries. Although aid expenditures have declined considerably in recent years, since 1970 they have averaged about $400 million per year.[8] In short, China is the only less-developed country that has not only relied minimally on foreign credits, but also has been able to sustain a rather successful foreign assistance program of its own.

Again, the comparison with India is instructive. India, since independence in 1947, has run an almost continuous foreign trade deficit. This deficit has been financed by foreign aid and capital inflows, primarily from the West, but in more recent years from the Soviet Union as well. Over the two decades from 1950 to 1970, India was the recipient of over $13 billion of net resource transfers (defined as imports less exports).[9] India, in fact, has been the largest recipient of developmental aid and concessionary loans in the world. Despite this generous assistance, which financed 15 to 20 percent of India's capital investment during these two decades, India's rate of growth of gross national product in per capita terms has been about one-third that of the Chinese. In the view of some observers, the refinancing of India's cumulative external debt seems likely to become a regular feature of the international monetary scene.

RECENT ECONOMIC PERFORMANCE

In marked contrast with this favorable long-term record of economic grown and minimal reliance on foreign financial credits, China's economic performance in the past 4 years has been comparatively unfavorable. The rate of economic growth since 1974 has fallen far below the long-term average, and an unprecedented balance-of-trade deficit was incurred in 1974 and 1975. These developments have beset the current leadership with the most profound set of economic problems China has confronted in over a decade. The paragraphs below will detail the extent of the economic downturn and examine a number of hypotheses that have been suggested to account for the decline in economic performance of recent years.

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[8] John Franklin Copper, "China's Foreign Aid in 1976," "Current Scene," vol. 15, Nos. 6 and 7 (June-July, 1977), p. 13.

[9] John Mellor, "The New Economics of Growth."

Most significantly, agricultural output during the 2 years 1976–77 does not appear to have risen significantly above the level of the 1974–75 harvests.[10] As a result, China's imports of food grains increased sharply to almost 7 million metric tons in 1977 and will remain above average this year. This, of course, has absorbed a considerable portion of China's foreign exchange earnings and has depressed China's program to import modern plant, machinery, and equipment from the West. Poor performance has not been limited to food grains. Output of major industrial crops such as soybeans and rapeseed has also grown relatively slowly while cotton output has declined sharply.

Equally important, China's rate of industrial growth has fallen to about one-half of the long-term rate of 12 percent that had been achieved between 1952 and 1973.[11] Industrial output grew by less than 5 percent in 1974 and then recovered to about 15 percent in 1975.[12] In 1976, industrial growth came to a standstill or perhaps even registered a decline of about 5 percent.[13] Several provinces were particularly affected, with decline of industrial output of 20 percent or more. 1977 was a year of rapid recovery with industrial output growth apparently approaching 14 percent.[14] As a result the level of industrial ouput in 1977 was substantially less than it otherwise would have been, and industrial investment was significantly depressed, particularly in 1974 and 1976.

Finally the decline in China's economic performance over the past few years was reflected in the emergence of a large trade imbalance beginning in 1973 and a sharp decline in the rate of trade expansion. During 1974 the prices of industrial goods imported from the West rose sharply as a result of world-wide inflation.[15] At the same time Western demand for many of China's traditional exports, particularly cotton textiles, was shrinking. As a result a trade deficit of $200 million in 1973 grew to about $800 million in 1974.[16] Beginning in 1975 the Chinese sharply curtailed the growth of imports while attempting to step up their exports. Consequently the trade deficit was cut by three-fourths in 1975 and a surplus of about $2½ billion cumulated during 1976–77. Consequently, in sharp contrast to the 1970–74 period when imports (in constant prices) were growing by about 12 percent annually and constituted a dynamic sector of the economy, imports in 1977 (in constant prices) remained well below the level of 1974.

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[10] China's food grain output (including soybeans and potatoes in grain equivalent weight) was 274.9 million metric tons in 1974, according to a statement of Yang Li-kung, Vice Minister of Agriculture at an FAO conference in Rome in November 1975. Data for the harvests since then are quite limited. The 1975 harvest appears to have been 280 million metric tons. See "Wen-hui pao" (Hong Kong) Mar. 9, 1978, p. 7; and International Rice Research Institute, "Rice Research and Production in China: An IRRI Team's View." Los Baños, Philippines, 1978, p. 77. Estimates for 1976 and 1977 are subject to a higher margin of error, but the harvests appear to have been in the 275 to 285 million ton range in both years with the 1977 harvest somewhat below that of 1976.

[11] Robert M. Field, Nicholas R. Lardy, and John P. Emerson, "A Reconstruction of the Gross Value of Industrial Output by Province in the People's Republic of China: 1949–73," Foreign Economic Report No. 7. Washington, D.C.: Department of Commerce, 1975, p.19.

[12] The 1974 growth is estimated from scattered provincial reports. The 1975 figure comes from Yü Ch'iu-li's speech to the Fourth Session of the standing Committee of the Fourth National People's Congress on 23 October 1977 in Foreign Broadcast Information Service, "Daily Report, People's Republic of China," Oct. 25, 1977, p. E6.

[13] This estimate is based on incomplete provincial reports and is subject to some error.

[14] Fourteen percent was the preliminary estimate given in the close of 1977. No final figure was released in the first quarter of 1978, and Hua's speech made no specific mention of industrial growth in 1977. Until more information is released, this figure should be treated with caution.

[15] Central Intelligence Agency, Office of Economic Research, "China: Real Trends in Trade with Non-Communist Countries since 1970," October 1977.

[16] The trade data cited here and in the remainder of this paragraph are taken from Central Intelligence Agency, Office of Economic Research, "China: International Trade, 1976–77," November, 1977 and from reports released by the Japanese External Trade Research Organization.

CAUSES OF THE DECLINE

A number of hypotheses have been advanced to explain the recent sharp reversal of economic performance. These hypotheses are worth examining in some detail since they not only reveal the character of the critical problems that have confronted the post-Mao leadership, but also because they have somewhat different implications for the prospects for achieving the goals incorporated in the Ten Year Plan.

The most obvious hypothesis attributes China's recent poor economic performance to political developments, notably the sequence of events following the death of Chou En-lai in January 1976. These include the purge of the Vice Premier Teng Hsiao-p'ing in early April and the virulent attack on a set of economic policies which were attributed to Teng but appeared to differ only marginally from the overall strategy of economic development that had been enunciated by Chou at the Fourth National People's Congress in January 1975.[17] In retrospect, however, it is clear that political events had begun to have an adverse effect on economic development as early as late 1973. The campaign against Lin Piao (the former Defense Minister who died while apparently attempting to escape to the Soviet Union) gave rise to deep factional cleavages in many industrial enterprises, leading to worker sabotage in some factories and widespread disruptions of the transport system. Although it was difficult to judge the effect of these activities on economic production, provincial data released in radio broadcasts made it possible to identify some of the most troublesome areas, most clearly Chekiang Province. Industrial output in Chekiang fell by over 10 percent in 1974, largely due to widespread disruption of production in Hangchow where several thousand People's Liberation Army troops were finally dispatched in 1975 to restore order.

While there was increased stability and recovery in 1975, 1976 was again marked by exceptional political disruption and uncertainty. During 1976, it became clear that the effect was not simply to close down factories for extended periods but also, more significantly, to undermine the consensus in support of the 10-year plan that had been formulated by the summer of 1975 and that was to have gone into effect in 1976. In the latter part of 1975, the followers of Madame Mao, as part of their attack on Teng Hsiao-p'ing, raised a series of objections to the plan. In retrospect it is clear that crucial aspects of the strategy embodied in the plan had come under sharp attack and were discussed throughout most of 1976. Not until after Madame Mao's followers had been arrested in the fall of 1976 and Teng Hsiao-p'ing was officially rehabilitated in the spring of 1977 did the economy begin to recover from the sharp decline that had been caused by the paralysis of the planning process, widespread work stoppages, and disruptions of the transport system.

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[17] These criticisms were contained in a series of articles published in the Shanghai journal "Hsüeh-hsi yü p'i-p'an" (Studies and Criticism) in the spring of 1976.

A second hypothesis suggests that the decline in performance, particularly in the industrial sector, is the result of a long-term decline in labor productivity. Because industrial profits have been reinvested rather then being used to finance wage increases, the average wage in manufacturing was constant for the the 20 years between 1957 and late 1977.[18] Because wage policy during the First Five Year Plan period explicitly linked the growth of real wages to increases in labor productivity, it has become increasingly difficult to motivate workers without wage increases. As a result, while the long term rate of growth of labor productivity is high, there has been little improvement in the past few years. In short, this hypothesis suggests that ideology increasingly has become a less effective substitute for material incentives.

A third hypothesis suggests that growth has slowed because of the cumulative effect of misallocated investment resources. Without the guidance of scarcity-based market prices or the use of relatively sophisticated planning techniques, Chinese planners may have neglected significant sectors of the economy. Long-term misallocation, in this view, has now had widespread unfavorable repercussions throughout the economy, depressing the rate of growth below its long-term level. The sectors thought to be the most neglected are coal, electric power, and transport. The shortage of transport capacity, for example, is thought to have contributed to delays in production as crucial inputs are not being delivered according to schedule. The apparent unwillingness of the Government to modernize the coal industry has resulted in a very slow rate of growth of output. Shortages of coal have, in the short run, depressed the rate of growth in other industries. And the longrun consequence is that in industry, petroleum-based energy sources are increasingly substituted for coal, reducing the amount of oil available for export.

A fourth hypothesis attributes the decline in the rate of growth to an ever increasing burden of agriculture on the rest of the economy.[19] In this view the Government has been forced to allocate an increasing share of investment resources to agriculture simply to maintain a rate of growth of agricultural output sufficient to feed a population which is currently expanding by about 15 million persons per year. The economics of producing adequate food on a fixed quantity of arable land (the amount of land under cultivation in China does not appear to have increased since 1957) are quite unfavorable. The gains in output that could be achieved through the strategy of increased mobilization of traditional resources within the confines of an unchanging agricultural technology were largely exhausted in the 1950's. In the early 1960's the leadership recognized that future agricultural growth would depend on the allocation of modern industrial inputs to the agricultural sector. But as more and more resources are applied to a relatively small fixed quantity of land, diminishing returns set in. Thus an ever growing quantity of chemical fertilizers, certain types of agricultural machinery, particularly irrigation equipment, is required to compensate for the fixed quantity of arable land.

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[18] Nicholas R. Lardy, "Economic Growth and Distribution in China." Cambridge University Press, 1978, pp. 174-175.

[19] Robert F. Dernberger, "China's Economic Future," in Allen S. Whiting and Robert F. Dernberger "China's Future: Foreign Policy and Economic Development in the Post-Mao Era." New York: McGraw-Hill Book Co., 1977.

The option of meeting incremental food requirements through imports is foreclosed not so much by the doctrine of self-reliance as by sheer economic necessity. Any attempt by a country comprising one-fifth of the world's population to satisfy its annual incremental food requirements entirely through imports would, at least in the short run, exert substantial upward pressure on prices in world markets. Thus the combination of diminishing returns and the need to remain largely self-sufficient in food grain supplies necessitates that the leadership allocate an ever growing share of resources to the less productive agricultural sector. Because the capital output ratio (the incremental quantity of investment necessary to generate a given increase in output) is much higher in agriculture than in industry, the allocation of investment is shifting to a pattern that is less favorable for maintaining rapid economic growth.

A final hypothesis suggests that much of the decline in the performance of the economy can be traced to the direct and indirect effects of the earthquake which struck Hopei Province in July 1976. As the veil of secrecy surrounding the earthquake is slowly raised it is clear that the loss of life and physical damage were enormous. Upward of three-quarters of a million people were apparently killed and T'angshan, a major industrial city, was leveled.

Evaluation and Implications

In my view, the major causes of the downturn in economic performance in recent years appear to be transitory and potentially reversible. Political disruptions in 1974 and 1976, the Hopei earthquake in 1976, and poor weather in both 1976 and 1977, rather than long-term structural causes, appear to be the most important explanatory variables. This interpretation is, of course, subjective and given the paucity of economic data available, cannot be tested rigorously. The evidence and analysis supporting this interpretation is set forth below.

First, the pattern of provincial industrial development over the past few years suggests that political forces have outweighted long-term structural factors as causes of the decline in industrial growth. Most important the slowdown in industrial growth has occurred primarily because of significant declines in the absolute level of industrial output in some provinces rather than an across the board slowing of the growth rate.[20] On the basis of scattered reports, it would appear that a few provinces have been able to maintain rates of industrial growth approaching their long-run average rates. Such widely separated provinces as Heilungkiang and Kwangtung would appear to fall into this category. On the other hand, regions where political strife was most intense in 1974 and 1976 suffered absolute declines in industrial output. In Kweichow, for example, industrial output appears to have fallen by about one-third in 1974. After recovering in 1975, output again fell in 1976, perhaps by 40 percent or more. Industrial output in Chuchou, an important industrial center in Hunan, fell by 31 percent in 1974. After recovering in 1975, output fell again in 1976. In Chekiang Province output fell significantly in 1974 and then continued to fall in 1975 and again in 1976. It was not until 1977 that the level of industrial output in Chekiang recovered to the levels achieved in 1973—the previous peak level of output. Industrial output also fell by about 16 percent in Hopei in 1976, although the cause was the July earthquake rather than political forces.

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[20] The analysis presented below is based on provincial reports.

In short, over the past few years there has been sharply increased variation in the pattern of provincial industrial growth. This pattern suggests that the decline in the national rate of growth is the result of disruptions of growth that have been particularly severe in some regions, rather than the result of systematic forces, such as misallocation of investment funds, that would be expected to have a more uniform effect on provincial industrial growth.

Second, stagnation of agricultural output since 1974 also appears to reflect primarily short-run forces. China's agriculture most certainly has not encountered some biologically determined ceiling level of output and the prospects for sustained growth are quite favorable, particularly compared to many other Asian countries at comparable levels of economic development. I believe the argument that China's agriculture has been subject to sharply diminishing returns tends to underestimate the importance of technical change that has occurred since the shift in agricultural development policy of the early 1960's. Rather stagnation appears to have been caused by a disruption in the flow into agriculture of modern inputs produced by the industrial sector, poor weather in 1976 and 1977, and perhaps by management problems that have reduced peasant incentives.

Since the mid-1960's, agricultural growth has become dependent on increased supplies of chemical fertilizers and farm machinery particularly power tillers and electric and diesel pumps for irrigation systems. Because of weaknesses in the industrial sector discussed above, there was a sharp decline in the growth of these inputs after 1974. Following several years of rapid development, the production of chemical fertilizers was basically unchanged in the 4 years between 1973 and 1976.[21] The total supply of plant nutrients from inorganic sources has actually declined because the quantity of imported fertilizers, after reaching a peak in 1972, has fallen, particularly since 1973. This, of course, was partially due to the policy of reducing imports after trade deficits were incurred in 1973–75. The growth of incremental supplies of other inputs to agriculture has also declined sharply. The inventory of powered irrigation equipment grew by 13 million horsepower in 1974 and 1975 but by only 7 million horsepower in 1976 and 1977. Numerous qualitative reports also suggest that agriclutural production has been set back because of shortage of electric power, fuels, et cetera. In summary, agricultural growth after 1974 has been impaired partly by failures in the industrial sector.

Poor weather in 1976 and 1977 has also depressed the growth of agricultural output below its long term rate. The influence of weather on Chinese agricultural output is extremely difficult to measure with the information that is freely available outside of China and this difficulty is compounded by the tendency of the Chinese to emphasize weather problems when there are shortfalls in harvests. Even after allowing for these considerations, it would appear that widespread flooding in 1976 and drought in 1977 depressed agricultural output significantly.

Finally, judging from Chinese press reports, in some regions there has been a tendency in recent years for higher level authorities within the commune system to undermine the autonomy of China's basic level of agriculture, the production team. In violation of previously established practices, higher levels appear to have appropriated both team manpower and funds for projects without seeking team approval. Because these projects in many cases appeared to have little or no benefits for the teams concerned, work incentives at the team level were reduced significantly.

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[21] Christine Pui Wah Wong, "Nutrient Supplies in the People's Republic of China," unpublished paper, March 1978, table 1A.

These three causes of agricultural stagnation appear to be largely transitory. Over the long run the influence of weather will be less adverse than in 1976 and 1977. The flow of modern industrial sector inputs into agriculture began to grow again toward the end of 1977 and will almost certainly resume the pattern that was evident prior to 1974. The January 1978 speech of Yü Ch'iu-li, the Chairman of the State Planning Commission, clearly signaled a determination to restore the growth of production of chemical fertilizers, tractors and hand tillers, implements, and pumps.[22] In addition to increased output of these products Yü's speech also called for improved quality and increased standardization of parts and components that will increase the efficiency with which these increased inputs are utilized. Finally with regard to incentives, a major thrust of policy since late 1977 has been the restoration of team level autonomy and increased work incentives as embodied in the phrase "more pay for more work, less pay for less work, and no pay for no work." The new state constitution also makes it clear that the ultimate goal of shifting the level of economic accounting to the brigade level has been deferred until "conditions are ripe." [23] Yeh Chien-ying's report on the constitution specified that these conditions include a relatively even level of development among a brigade's production teams.[24] If this policy is followed it will eliminate the major objection to the brigade as the basic level of economic accounting and income distribution.

The long-term prospects for agricultural growth in China appear quite favorable both because of the huge investments that already have been made in land infrastructure and because of the speed with which high-yielding technologies are adopted.

Since China's present cultivated area is about the same as in the mid-1950's, the growth of food grain output over the past two decades has been due largely to increased yields and intensity of agricultural cultivation that, in turn, have depended on improved water control and earlier maturing and higher yielding seed varieties. China's plant breeding program, in both rice and wheat, has been quite successful in developing faster maturing varieties that have allowed increased multiple cropping and thus increased yields per unit of cultivated land. But yields per unit of sown area of rice, far and away China's most important grain crop, remain far behind those achieved by other successful agricultural modernizers in Asia. This is partly because seed development has emphasized early maturation more than high yields and, more importantly, because the level of fertilizer application remains far below optium levels. Levels of nitrogen nutrients, even when organic sources are taken into account, remain far below the levels applied in Taiwan, South Korea, and Japan and Western plant scientists who have had an opportunity to make field observations have frequently noted symptoms of nitrogen difficiency in Chinese crops.[25]

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[22] Yü Ch'iu-li speech at the Third National Conference on Agricultural Mechanization, January 26, 1978. Foreign Broadcast Information Service, "Daily Report, People's Republic of China" January 31, 1978, pp. E6–E25.

[23] "The Constitution of the People's Republic of China" adopted March 5, 1978, Chapter one, Article 7. Peking Review No. 11, 1978 (March 17, 1978), p. 7.

[24] Yeh Chien-ying, "Report on the Revision of the Constitution," Peking Review No. 11, 1978 (March 17, 1978) pp. 23–24.

As the level of chemical fertilizer application increases and higher yielding seeds are developed and diffused over a wider area, China's food grain production should grow significantly.[26] Chinese rice yields of 3.4 tons per hectare in 1976, are only marginally greater than those achieved in Japan in the 1920's, before the widespread use of chemical fertilizers, and a little more than half present day Japanese rice yields. Careful historical research on Japanese agriculture,[27] and evidence from elsewhere in Asia shows that land infrastructure is frequently the major obstacle to the achievement of output growth when improved seed varieties are diffused and fertilizer input levels are increased. Because China has already achieved a remarkably high degree of control of water in rice farming,[28] they are well prepared to make maximum advantage from the increased levels of fertilizer availability that are planned over the next few years. Similarly, compared to other Asian countries where there are enormous obstacles to the diffusion of high yielding seed varieties and improved farming practices,[29] the Chinese have been remarkably successful in realizing the adoption of high-yielding technologies.[30]

The above evaluation of China's economic performance in recent years, if correct, has several important implications. First, the evaluation suggests that the recovery of industrial output in 1977 represents a return to the pre-1974 pattern of growth rather than a continuation of the fluctuating pattern of industrial performance observed over the past few years. Given political stability rapid growth should be sustained for several years. This view would also seem to be corroborated by a series of major conferences convened in China beginning in 1976. In addition to important conferences dealing with all of industry and agriculture, there have been significant specialized conferences dealing with important branches of industry such as coal, metallurgy, electric power, and railroads as well as functional conferences dealing with finance and banking, supply and marketing, and capital construction. These conferences, of course, culminated in the Ten Year Plan which was approved by the Fifth National People's Congress in February 1978.

The predominant theme of these conferences is the return to sustained and rapid economic growth. Renewed emphasis is to be given to rigorous cost accounting, improved enterprise management through strengthening the authority of plant managers, and centralized planning. The ability of the new regime to announce new policies suggests that the paralysis of the economic decisionmaking process, so evident in 1976, has come to an end. That is, the large meetings attended by several thousand representatives from throughout the country in 1977, were called primarily as a means of disseminating a new policy line that was already confirmed at the highest levels rather than serving as a forum for the actual resolution of policy problems. This has subsequently been confirmed by the pro forma approval of the plan at the Fifth Congress.

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[25] See for example, "Plant Studies in the People's Republic of China: A Trip Report of the American Plant Studies Delegation." Washington, D.C.: National Academy of Sciences, 1975, pp. 29–30 and "Wheat in the People's Republic of China." Washington, D.C.: National Academy of Sciences, 1977, pp. 2, 6, 14.

[26] International Rice Research Institute, "Rice Research and Production in China: an IRRI Team's View." Los Banos, Philippines, 1978, p. 43. "Wheat in the People's Republic of China," p. 121.

[27] Yujiro Hayami, "A Century of Agricultural Growth in Japan: Its Relevance to Asian Development." Tokyo: University of Tokyo Press, 1975. p. 189.

[28] James E. Nickum, "Hydraulic Engineering and Water Resources in the People's Republic of China: Report of the U.S. Water Resources Delegation." Stanford, Calif.: U.S.-China Relations Program, 1977. p. 52. International Rice Research Institute, "Rice Research and Production in China." p. 14.

[29] International Rice Research Institute. "Constraints to High Yields on Asian Rice Farms: An Interim Report." Los Banos, Philippines, 1977.

[30] International Rice Research Institute, "Rice Research and Production in China," pp. 12–13.

A second important implication of the optimistic projection for economic growth is that a number of important and previously divisive economic policy issues have already been resolved. The most crucial of these issues are wage policy and the degree of reliance on imported foreign technology. It is frequently argued that the leadership faces a fundamental dilemma in any effort either to modify the structure of wages in manufacturing to provide greater skill incentives, for example, or to raise the average wage level. On the one hand to increase the average wage and avoid inflation would require a reallocation of investment away from capital goods and toward manufactured consumer goods. Thus the wage increase would reduce the rate of investment. On the other hand to increase wages without increasing the supply of manufactured consumer goods and cutting back on the rate of investment is a certain invitation to inflation. In this view the leadership is faced with the unpleasant choice between reducing the rate of investment and ultimately the rate of growth or abandoning their conservative monetary policy and allowing a rate of inflation that would be unprecedented in the last 25 years.

It is far more likely, however, that the modest realinement of the wage structure undertaken in late 1977, which included a 10-percent increase in the wages of almost two-thirds of all staff and workers and a limited reintroduction of bonus systems, will have a substantial positive feedback on labor productivity. This feedback would raise the rate of economic growth and thus allow the Chinese both to maintain a very high rate of investment and to step up production of manufactured consumer goods, thus avoiding inflation. In short, the wage increase is not necessarily a no-win situation for the leadership. It might reap a very substantial payoff from only a modest increase in the total wage bill.

It also appears that the Chinese have reached a consensus on the degree of reliance on imported foreign technology and the financial practices to be used to pay for imported plant and equipment. The formulation of China's Fourth 5-Year Plan (1971–75) was based on a fundamental liberalization of their approach to foreign trade—a shift from what might be generally described as a strategy of minimization of imports to what appeared to be a strategy of minimizing reliance on foreign credits. The consequence of this shift in strategy was a sharp spurt in total trade volume—indeed, 1971–74 is the only period since 1955, when net Soviet credits were terminated, during which the rate of growth of foreign trade (measured in constant prices) exceeded the rate of growth of industrial output. From the point of view of the Chinese, the timing of this accelerated pace of foreign trade, was however, most unfortunate. Changing world market conditions, that is the combination of significant price inflation and recession in the West, significantly reduced the demand for many of China's traditional exports, while at the same time forced the Chinese to import at substantially increased prices. Consequently China's terms of trade (the ratio of the prices of exported goods to the prices of imported goods) fell sharply. Rather than drastically cutting the level of imports to maintain a balanced trade account, the Chinese chose to stretch its policy of minimal reliance on foreign credits in order to maintain a significant flow of imported plant and equipment. Evidence of this stretching came primarily in the form of Chinese acceptance of medium-term loans under the rubric of "deferred payments" which allow the Chinese to stretch out the payments for import of complete plants ("turn key projects") over a 5-year period that begins only after the construction is completed. Consequently in 1974 and 1975 the Chinese accumulated a foreign trade deficit of about U.S. $1 billion.

In addition to stretching its policy of minimal reliance on foreign credits in 1974–75, Chinese planners also attempted to shift the composition of reduced imports to avoid sharply reducing the quantity of imported plant, machinery, and equipment that are vital to achieving the modernization goals originally announced by Chou En-lai and recently reaffirmed by Hun Kuo-feng in his February 1978 speech. Specifically, although total imports fell in 1975, the value of imported plant, machinery, and equipment actually rose in 1975 to $2.2 billion. The modest fall (relative to the decline in the total import bill) in these imports to $1.8 billion in 1976, partly was due to a substantially improved harvest in 1974 and modest growth in 1975 that allowed Peking to curtail significantly the volume of imported food grains from an average of 7.3 million metric tons in 1973 and 1974 to 1.9 million metric tons in 1976. Thus at least through 1976 the Chinese attempted to maintain their imports of plant, machinery, and equipment, a marked departure from previous recessions in which capital goods imports have fallen rapidly in response to worsening domestic economic performance.

Poor harvests in 1976 and 1977 are, however, now reversing this process and the value of imported capital goods is falling rapidly as agricultural imports grow. The value of imported agricultural products roughly doubled in 1977 to about $1½ billion and seems certain to be maintained at this level in 1978. Consequently, imports of plant, machinery, and equipment declined sharply in 1977, perhaps to as low as $1 billion.

Despite these unfavorable circumstances, the Chinese seem determined to resume the pattern of foreign trade of 1970–74 when imports, particularly of capital goods, were growing rapidly. Thus the Chinese seem to have resolved the divisive arguments on foreign trade strategy that marked much of 1976. A series of articles have appeared in the Chinese press to explain the necessity of selected imports of Western technology if they are to meet their very ambitious goals for economic growth. The emphasis in these articles appears to be more on the Maoist dictum of "keeping the initiative in our own hands" rather than excluding imports or minimizing foreign trade. This suggests that while the Chinese for the time being are certainly not prepared to consider direct foreign investment or even joint ventures, that the main constraints on imports will be financial rather than ideological. This view seems to be supported by the increased number of Western firms that have been invited to Peking to discuss a broad range of capital goods exports to China, as well as a step up of industrial exchange activities.

There is also evidence of a new positive attitude on the part of the Chinese toward export promotion which is rather different from that which prevailed in the past. The Chinese have adopted far more flexible attitudes with regard to provision for inspection of Chinese goods, the testing and labelling according to U.S. standards of pharmaceuticals exported to the United States and meeting the stipulations of the U.S. Food and Drug Administration for food products exported to the United States in order to expand their export markets.

The long-term trade agreements signed in the first quarter of 1978 with both Japan and the European Common Market underline this Chinese commitment to accelerate the transfer of foreign technology to China. The accord with Japan is particularly significant since the Japanese will supply China with $7 to $8 billion of complete plants and $2 to $3 billion in construction materials and equipment during 1978–85. These imports of plant and technology will be concentrated in petroleum, coal mining, metallurgy, power generation, and transport. Over the period of the agreement, these imports will be financed by increased exports of raw materials to Japan—primarily of crude oil and coal. But the bulk of China's capital goods imports will be completed in the early years of the agreement whereas Chinese raw material exports are planned to begin at modest levels in 1978, grow moderately in 1979–81, and then increase sharply in 1982. Thus, the Chinese asked for and were granted deferred payments, which will be underwritten by the Japanese Export-Import Bank, to finance the imbalances that will occur in the early years of the agreement. Since there will be substantial trade with Japan in addition to that covered by the long-term agreement, total trade with Japan will grow rapidly and the supply of imported capital goods will increase sharply. The agreement with the European Economic Community, which collectively is China's second largest trading partner after Japan, does not specify the volume of anticipated trade. But numerous Chinese industrial trade delegations have been visiting Europe since 1977, suggesting that there will also be an upturn in trade beginning in 1978–79.

Summary and Prospects

The primary causes of China's declining economic performance since 1974 appear to be short term and political in character rather than long term and structural. The adverse influence of these short-term elements appears to have receded rapidly, due largely to the decisive actions taken by the new government since late 1976. However, even if we could confidently assume future political stability, the target rates of growth included in the 10-year plan remain quite ambitious.

The broad targets for 1978–85 are, however, only marginally higher than those achieved during the decade prior to the recent economic decline. Thus, the 10-year plan bears little resemblance with the wildly optimistic plans that were advanced during the Great Leap Forward in the late 1950's. The planned rate of development of industry, 10 percent per year, is the same as that achieved during the 1964–74 decade. The possibility of slightly better future performance cannot be ruled out since the 1964–74 decade included the Cultural Revolution that had a significantly adverse effect on industrial production and investment. The prospects for the coming years are also enhanced by the more realistic assessments that have been made of lagging industrial branches such as coal. After years of minimizing investments in the coal industry, the new plan envisages widespread mechanization of the industry, partly through imported equipment. This should help to alleviate chronic coal shortages that have had an adverse effect on other branches of industry.

In the agricultural sector, the planned rate of growth, from 4 to 5 percent per year from 1978 through 1985, is higher than the 3½ percent annual gains achieved in the 1964–74 decade. Consequently, it seems unlikely that China will achieve the target of 400 million metric tons of food grains by 1985. Yet, because of the large investments that have already been made in irrigation systems and the ability of the Chinese to diffuse rapidly higher yielding seed varieties, the average rate of agricultural growth may approach 4 percent per year, given average weather conditions. Because of the significant decline in the rate of population growth that has been underway for some time, an average rate of growth of 3½ to 4 percent would be a considerable accomplishment. Food grain output would be over 350 million metric tons in 1985 and per capita food supplies would be significantly higher than at present. An average annual increase of 3½ to 4 percent would result in more than a 2 : 1 margin between the rate of growth of agricultural output and population growth.[31] In most other Asian countries at comparable levels of development, rates of growth of food output are barely equal to population growth.

A return to economic performance similar to that of the 1964–74 decade, however, is dependent on two crucial conditions. First, there must be a stable political environment that is conducive to long-run economic planning. In the absence of automatic mechanisms for determining the allocation of resources, these decisions are made through a direct political process that is extremely vulnerable to disruption. If the political consensus that appears to underlie the 10-year plan should be shaken, there could be a renewed paralysis of the planning process, a deferral of investment decisions, and a decline in the rate of economic growth.

A second condition for the resumption of sustained growth is the deferral of the modernization of China's military establishment. The underlying scarcity of resources and the envisaged increase in the flow of investment to improved social services and transportation infrastructure; to scientific and technical modernization; as well as to industry and agriculture implies that the share of resources allocated to the military cannot be increased substantially. China's national defense is still to be modernized by the end of the century. But high resource costs and technical difficulties will mean that an across-the-board modernization program will have to be deferred well into the 1980's if goals in other sectors are to be met. This will not preclude either a rising absolute level of defense expenditure or significant improvements in selected weapons systems, but a systematic modernization program will depend on a more developed industrial sector.

Ironically, debate over the priority to be given to military modernization is most likely to erode the consensus upon which the 10-year plan is based. There is considerable indirect evidence of an important debate between those who prefer to postpone military modernization in order to achieve gains in other sectors, particularly agriculture, and those who prefer to allocate more resources to defense and its supporting heavy industries at the expense of agriculture and manufactured consumer goods. Hua's report to the fifth congress, which gave bare mention to modernizing defense, suggest a consensus was finally achieved for deferring military modernization. But this issue is certain to be raised again when the broad goals of the 10-year plan are transformed into more detailed and operational annual economic plans.

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[31] Based on a projected further decline in the rate of natural increase to 1.7 percent by 1980 and to 1.3 percent by 1985. John S. Aird, "Population Growth in the People's Republic of China," Table 2, Intermediate Model.

THE POLITICAL DYNAMICS OF THE PEOPLE'S REPUBLIC OF CHINA

By William W. Whitson*

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Introduction

Is the economy of the People's Republic of China likely to be substantially influenced by "politics"? That is, does a reading of the record of the past 30 years suggest that future policy conflicts among Chinese over the "proper" allocation of political power among themselves, and over the style of decisionmaking and issue resolution might substantially affect prospects for economic growth? The answer appears to be a resounding "yes; but * * * ." The qualification is an admission of the failure of both political scientists and economists to sort out the precise relationship between Chinese Communist political structure and style on the one hand, and economic development, on the other. That the two are interdependent cannot be disputed. But answers to questions of cause and effect elude the most meticulous student of both fields. The impact of a succession of political decisions on the dynamics of the economy is generally accepted; but it has proved impossible to link specific economic consequences with specific political decisions.

Though China specialists and U.S. policymakers are far from precision in their understanding of the relationship between politics and the dynamics of the Chinese economy, one key to better understanding and prediction is a recognition of the multiple bases on which China's political alliances are built. Policy arguments are couched in ideological language, and indeed, ideological cleavages are significant ones. Increasingly, however, over the past quarter century, three other sets of cleavages, and patterns of loyalties they engender, have shaped the political process in China: Generational, regional, and bureacratic.

Sometimes, for the individual, these loyalties are mutually reinforcing in support of a policy decision. More often, however, they put the individual under cross pressures; that is, his competing loyalties dictate support for conflicting policies. Factional strength is thus precarious, and can be shifted by skillful appeals to groups under cross pressures.

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In consequence carefully built compromises among competing loyalties are destined to be altered as their relative importance changes under the pressure of issues. Though our understanding of this process is still rudimentary, such a mode of analysis can be useful giving shape and a sense of dynamics to the process of economic policymaking in China.

The following pages briefly outline the elements of the four major cleavages that shape patterns of loyalties in Chinese politics—the ideological, the generational, the regional, and the bureaucratic—and then sketch how evolving and shifting coalitions have contributed to cyclic patterns in political power structure and style since 1949. This sets the stage for a review of the most critical domestic and foreign political issues currently confronting the leadership, and finally, an assessment of the potential impact on political stability should the leadership choose to depart from policy directions that seem to have emerged since Mao's death.

Political Loyalties

Generational loyalties are the most difficult to assess. Nevertheless, these form the basis for many "old boy networks," each drawing its strength from a unique history of shared crises and achievements.[1] Four distinctive generational groupings deserve attention: pre-World War II; the War Years; the Cultural Revolution; and the post-Cultural Revolution.

The great majority of the leaders drawn from the pre-World War II years (1922–36) come from the six provinces bordering the Yangtze River. They may, therefore, be called the Southern Revolutionaries. From this group came the "Long Marchers," participants in the epic strategic withdrawal from their fertile but politically hostile homeland to a barren and forbidding loess plateau west of the Yellow River. Men and women who conceived and made a great revolution, these leaders are generalists with long memories and haunting doubts about their legacy to their beloved country. Because most of them are in their seventies, little time remains in which they may place the permanent stamp of their vision, their waning energy, and their enormous experience in China. Most of the central Peking leadership, including the Deputy Premier, Teng Hsiao-p'ing, the new Minister of Defense, Hsu Hsiang-ch'ien, the President of the National People's Congress and former Defense Minister, Yeh Chien-ying, the most of the 11 military regional commanders and chairmen of provincial revolutionary committees belong to this generation. Their influence is still decisive; but their losses in 1976 (e.g., Chou En-Lai, Mao Tse-Tung, Chu Te, Kang Sheng and Tung Pi-Wu) warned them that time is running out.

The great majority of the important leaders drawn from 16 continous "war years" (Sino-Japanese War, Civil War, and Korean war: 1937–53) come from provinces north of the Yellow River. They may, therefore, be called the Northern Warriors. Like the Southern Revolutionaries, they formed strong factional ties, forged in battle, death, and great victory. Generally better educated than the older group, more inclined to specialization and professionalism, many of these people came from conservative middle-class families and joined the cause of the nation, not of communism, when a foreign enemy threatened. In many ways less regionally parochial, more technically qualified, and even more patriotic than the older generation, this generation now manages most of the ministries, the top staffs of the military establishment and the key operating units of the People's Liberation Army. The new Premier, Hua Kuo-feng, is a member of this northern warrior group. Now in their late fifties and early sixties, they focus their energies on the management of the present rather than either the atonement of the past or the judgement of history.

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[1] For a more detailed analysis of generations in China's elite, see William W. Whitson, "The Chinese High Command" (New York, Praeger, 1973), ch. 9.

The "Cultural Revolution generation" is composed of young men and women who entered the political arena after 1953 and dared to believe and adopt the idealism of the older generations, especially the Southern Revolutionaries who had written extensively about the spirit of the revolution when few resources other than esprit had been available. Drawn from all over China, and inspired to dedicate themselves to a new China, these young men and women might be called the Nation Builders. Turning away from classicists and the traditions of Chinese education and the traditional measures of worth in China, for 16 years the nation builders moved out of the cities and the farms of central China to the borders. Armed with Mao's thoughts, they largely succeeded in imposing a pervasive network of party and government systems and procedures on 800 million people. While increasingly conscious of "China" as a nation-state, this generation makes the machinery of China's political system work—and sometimes break down. Energetic and idealistic but also increasingly bureaucratic, professional and consumer oriented, they demonstrated their frustrations with both unrealized ideals and their own creaking bureaucracy from 1966 to 1968. At that time, the Great Proletarian Cultural Revolution became an epic watershed, probably the politically climactic period of their lives. Still sorting out the significance of that major social trauma for their generation, they have only limited impact on major decisions; but no major decisions can be carried out without them.

The post-Cultural Revolution generation, entering the political arena after 1969, is comprised of the majority of the population of the country. Only vaguely aware of the sacrifices and dedication of the first two generations, concerned with their own problems of immediate survival, this generation has no role in decisionmaking but can clearly frustrate or help realize the vision and managerial goals of older leaders. They are the grist of China's political mill and are probably less patient than either the Northern Warriors or the Nation Builders for the rewards of the new China. They may therefore be called the Consumer Generation. It will be these young men and women who will heed the call of their elders to fight the future political battles now forming already to challenge the prevailing compromise.

Regional loyalties may reinforce or undermine generational loyalties and give geographic focus to China's political system.

The issue is concerned with the power of central authority. Distribution of political power among the center, 11 major military regions and 29 provincial-level revolutionary committees, has fluctuated wildly since 1949. Depending upon the administrative or political issue, the long-term trend until 1976 had been toward delegation of considerable authority to lower-level leaders. That trend has been interrupted periodically by efforts at the center to retrieve control over certain issues. But the complexity of the Chinese political system, the size of the country and the slow development of its communication and transportation systems have encouraged the trend toward selective decentralization. The trend has been reinforced by the increased availability of competent administrators from the generation of the "Nation Builders."

While these young people have been encouraged to think in terms of China's needs, their limited mobility (with the exception of the Red Guard movement of the Cultural Revolution and the "down to the countryside" movement) and the old tradition of localism in Chinese politics have obstructed party efforts to raise the level of political vision beyond the boundaries of the home county or province. Thus, "regionalism" (primary loyalty to the needs, values, and goals of the locale rather than China as a whole) remains a powerful force in Chinese political dynamics and may often overwhelm the personalized ethic of an "old boy network" with its roots in the collective generational memory.

At risk of oversimplifying "the facts" while yet continuing a theme already suggested above, the locus of Chinese political power is shifting from the Southern Revolutionaries to the Northern Warriors. That this shift is an accident of the history of the Communist movement in China does not detract from its significance for changing priorities and perceptions of political issues.

From a Chinese viewpoint, the "Mason-Dixon Line of China" is the Huai River, flowing eastward along a course approximately 100 miles south of the railroad from Lienkang to Chengchou. In the field of foreign affairs, northern Chinese historically have been less tolerant of the Russians than have southerners. The north (especially in Manchuria) has had a more extensive and balanced experience with the Japanese than the south. From a northern viewpoint, the principal geopolitical threat is continental and Russian; southerners see the principal threat from the sea. The tradition and conditions of war for the north have demanded walled cities because the adversary could sweep into North China from the Mongolian steppes. Indeed, the Great Wall symbolizes this defensive mentality and its preoccupation with cavalry and nomadic fluidity. Conversely, the broken terrain of the south, extending from the South China Sea all the way to the Tibetan highlands, has encouraged guerrilla warfare, with small unit operations relying on dispersion, rather than concentration, of defensive forces.

In addition to the pull of generational and regional loyalties on the decisions of China's leadership, shorter term bureaucratic loyalties play an increasingly important role in the behavior of key political actors. Whether between party and military careerists or within those two huge, interlocking bureaucracies, the complexity of bureaucratic politics in China reflects pervasive careerists aspirations for power for its own sake. These aspirations and the games they evoke are most characteristic of the Northern Warrior generation, the men and women who made their early careers through 15 years of continuous warfare and now stand poised to take control of the entire political game from their elders.

Prior to 1949, careers were made and broken primarily through the traditional Chinese mode of personalized factional ("old boy") loyalties, increasingly formalized during the 1940's into mobile "field armies." When these field armies ended the Civil War in 1950 and settled down in regional roles of postwar economic reconstruction and political stabilization, the regional loyalty system began to unfold. Simultaneously, the search started for a national bureaucratic structure—a structure suited for managing a restive and talented population.

Unlike older generational and regional criteria for promotion, bureaucratic criteria would inevitably include such measures as professionalism, responsiveness to special bureaucratic organizational values and, ultimately, a careerist perspective which can argue seriously that "What's good for the Chinese Air Force (for example) must be good for the country."

Rarely would members of the Southern Revolutionary generation argue from such premises during the 25-year period after liberation; theirs was and is a different kind of parochialism. But the Northern Warrior generation and the younger Nation Builders had the technical education, the opportunity for specialization and the challenge of a burgeoning bureaucratic empire to inspire them to play the bureaucratic game. Today that game is highly developed in China and must be factored into any calculus of political behavior. What was once a "generalist" ethic associated with the older generation of revolutionaries, who combined party and military careers and functions as the need arose, has now been diffused into much more complicated, specialized ethical systems that begin to resemble the phenomena of American bureaucratic political life.

Thus the professionals of the civil bureaucracy are increasingly concerned with limiting the role of the military in decisions about scarce resources allocations. In a move to confirm the military role of senior officers, in the winter of 1973–74, Teng Hsiao-p'ing arranged the transfer of eight military regional commanders to new posts where they lost their key roles as chairmen of revolutionary committees. Thereafter, the movements to dislodge the military from provincial level civil management roles proceeded apace.

Concerned with economic development and the problems of an underemployed populance, civil leaders are inclined to emphasize internal political threats (to their own tenure, to stability, to goals of political and economic national integration, et cetera). Under the leadership of Teng Hsiao-p'ing, they take increasing exception to the older military "generalists," whose education and experience suited them for the demands of a revolution and a combat environment of small arms, not an environment of missiles.[2]

That same generation of elder military leaders find themselves under pressure from their juniors, increasingly professional and technically qualified and impatient to take over the high command. But such emphasis on military professionalism and "modernization" brings its own conflict with civil bureaucrats over the correct mix of guns versus butter. At stake is the issue of pace: how fast the PLA will receive new aircraft; how fast the PLA will receive improved communication equipment; how fast the older leaders will "retire"; how fast the older regionally based distribution of political-military power will be transformed into a truly national army.

Standing behind all three sets of demands on the loyalties of China's leaders are ideological conflicts. These involve conflicts in values, goals, and style dating back to the earliest arguments among the Southern Revolutionaries. Since 1949, those arguments have been clustered in two categories known as the two lines: radical and conservative.

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[2] See FBIS (PRE, Jan. 31, 1978, p. E1) for the left page article in People's Daily on January 30 regard Teng's 1975 criticisim of overstaffing, lethargy, arrogance, extravagance, laziness, and laxness in the PLA.

In their most extreme form, the radicals of the revolution are the priesthood of the movement. They measure costs and gains in ideological terms; their goal is the transformation of the Chinese soul from the patience and conservatism of the rural, tradition-bound peasant to the impatience and entrepreneurial daring of the factory, technical innovator. Their target is "the masses." Thus, at risk of destroying their own elite status and of low economic growth rates, they lean toward populism, the very real costs of economic self-sufficiency and the drama of struggle (including violent armed battle) as the preferred engine of rapid social change.

Conversely, the conservatives are the bankers of the movement. Favoring the values of "expertness" rather than "redness," they also wish to change the soul of China; but they prefer that an educated elite retain control of the process, in which compromise rather than struggle remains the central ethic of disciplined evolutionary, not revolutionary, change. At risk of delaying the rewards of such change for the masses, they prefer to concentrate limited resources for planned economic and political development.

THE CYCLE OF POLITICAL POWER

Since 1949, the interplay of the foregoing sets of loyalties has been reflected in a succession of changes in both the structure of political power and policy approaches to key political and economic issues.[3] Often explained primarily in terms of ideological controversy, these changes also reflected successive compromises forced by coalitions built on generational, regional, or bureaucratic loyalties as well. Table I reflects the phenomenon of the "4-year cycle"; that is, the fact that a shift has occurred approximately every 4 years to bring a new era in political or economic style and consequences. Rarely have such shifts been so abrupt as to preclude transition periods, usually lasting less than a year, when the outcome of a political struggle appeared moot. During such periods, students of China were usually unable to understand precisely what was happening or where the process was likely to lead.

For example, anyone who argued in 1977 that post-Mao conservatives had seized power and are unlikely to relinquish it would have done well to recall the testimony of China specialists before the Fulbright committee in the spring of 1966. One after another, they assured the committee that, come what may, the party was stable and would dominate political life in China. Within a year, the party had been so damaged by passions unleashed in the "Cultural Revolution" that only the discipline of the PLA, not the party, kept essential services functioning and moderated the excesses of youthful enthusiasm and frustration.

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[3] For a related phasing of economic developments since 1949, see **Ashbrook, p. 207,** for a discussion of the economic aspects of each of these phases in post-1949 Chinese history.

TABLE I.—*Political periods in China, 1950–78*

Title	*Dates*
Postwar stabilization	1950–53
Transition	1953–54
Postwar consolidation	1954–57
Transition	1957–58
The "Great Leap Forward"	1958–61
Transition	1961–62
Socialist transformation	1962–65
Transition	1965–66
The "Cultural Revolution"	1966–70
Transition	1970–71
Military administration	1971–75
Transition	1975–76
Post-Mao civil consolidation	1977–

During the first period of political stabilization (1950–53), a determination to spread Communist political control over the entire country (including Tibet) was guided by ideological commitments and founded on historic conflicts—and agreements—among key members of the southern revolutionary generation. A handful of old comrades temporarily held a monopoly of political power for application to two enormous challenges: internal stability and external military threat (in Korea). Thanks to a fund of mutual trust built up over their years of civil war, central leaders were able to delegate enormous authority to colleagues in remote provincial capitals. They applied positive and negative incentives, according to local needs, to assure Communist control. The Korean war, while draining critical resources, also assisted achievement of the primary internal goal by draining off the only potential source of residual organized resistance, the remnants of the Nationalist Army. Furthermore, the war temporarily removed most of the best qualified professional Communist military leadership, thus giving the party the edge over its potential adversary, the military, in establishing early primacy over local civil administration. Political processes during this period were not substantially influenced by regional and bureaucratic loyalties. But it was during this period that the foundations for those new loyalty systems were established.

With the ending of the Korean War in 1953, the return of key military leaders and regular forces set the stage for a new regionalism. One by one, PLA armies moved from the Korean peninsula back into metropolitan China. During the transition period from mid-1953 through the summer of 1954, decisions about the regional allocations of these forces and their proud leaders were fundamental political decisions destined to shape the emerging pattern of political conflict for the next 15 years.

By September 1954, the important decisions had been made and a reorganization of China's military structure confirmed the regional emphasis with the title "military region" applied to 13 huge areas for military (and ultimately political) jurisdiction. At the same time, the old "field armies" were disbanded, a crucial step in a process of eroding formal old boy networks from the civil war years.

Simultaneous with the founding of the new regionalism, the origins of intrabureaucratic conflict gave form to what has become an enduring jurisdictional debate. The Korean War era gave impetus to a fundamental strain of military and civil professionalism, always present in the PLA from its founding in 1927 and increasingly evident in the civil party and Government bureaucracies from as early as the days of the Central Kiangsi Republic. If the challenges of governing a huge land and a huge populace inspired the values of civil technical and administrative skill at home while the military fought a war abroad, the war inspired similar values among the military, daily facing the most sophisticated weaponry in the world. Upon returning to China, they wanted early and rapid modernization; they gave themselves rank and new uniforms; and they boasted of a burgeoning technical school system including a national defense college. Soviet officers from all services were busily engaged in transforming the PLA into a modern ground army.

During this period of Communist consolidation of power (1954–57), as Communist bureaucracy increased its grip on the land and the people, regional and bureaucratic competition for resources for hundreds of military and civil projects was partially muted by assistance from the U.S.S.R. Indeed, real and apparent success in mobilizing political and economic resources prompted experimentation with "letting a hundred flowers bloom." Shocked and disappointed by the depth of latent popular hostility and increasingly conscious of popular resentment against a proliferating and self-serving bureaucracy, "radical" ideologues promoted "the Great Leap" (1958–61).

The economic goals and consequences of this period are discussed by Ashbrook below. Multiple political purposes were embedded in this tension-laden experiment with mass participation in industrial production. At its heart was the same political goal as that of the "hundred flowers" episode of 1957: a rising sense of national unity through release of popular energy in a great national surge of public service. Results "on all fronts," in addition to the politically therapeutic benefits, would presumably sustain a pervasive sense of confidence in self, in the party and in the country.

Instead, the sloganeering of the 1957–58 transition evoked harsh criticism from the Minister of Defense, P'eng Te–huai, who publicly denounced the unprofessional, wishful initiatives of the "Maoists" and earned for himself and many around him a purge into political obscurity in late 1959. Determined to eradicate the bureaucratic elitism and excessive professionalism of the system, as it had evolved since 1959, the radicals went to the masses as well as like-minded colleagues to preach self-confidence and inspirational zeal.

When economic failure resulted, political failure followed. Desertions in the PLA frightened both civil and military leaders. Uprisings in several North China provinces warned local and national leaders that Communist control, so carefully nurtured since 1950, might be at stake. Reacting to a perceived lunacy of Maoism in both internal and external affairs, the Soviets decided to withdraw their economic and political support in 1960, thereby leaving several hundred projects in a semifinished, nonproductive condition.

Later to be condemned for his "capitalist roader" mentality, Liu Shao-ch'i demanded from his own generation and his bureaucratic subordinates bureaucratic solutions rather than ideological slogans. Between 1961 and 1962, a transition and winning coalition of conservative, pragmatic political and economic planners forced Chairman

Mao, according to his later testimony, "into the second line" of authority while the "conservatives" undertook to lead the country into a period of "Socialist transformation" (1962–65).

Dedicated to the reassertion of central authority over a restive and widely disillusioned populace, elitists including such figures as Chou En-lai, Yeh Chien-ying and the PLA Chief of Staff Lo Jui-ch'ing, supported by key party and military regional leaders, imposed disciplined resource allocations, and bureaucratic procedures, reinspired elan and tightened belts to accommodate to very real deprivation. The burgeoning professionalism of this period was increasingly evident across the board, culminating in the military with a 1965 plea from Chief of Staff Lo Jiu-ch'ing, for a nationwide weapons competition, serious war preparations against the United States and a forward defense along the Vietnam border.

However, despite the political goal of increased centralized control; regional "mountaintops" of elite privilege and power emerged during the post-"Great Leap" era. Powerful civil and military regional leaders, no longer as trusting of old generational colleagues in Peking—and in other regions—as they had been in the early 1950's, began to hoard both political and economic resources. The withdrawal of Russian assistance in 1960 had left the center's treasury seriously depleted. It was imperative for central leaders to assert greater control over surplus production in the wealthier regions and cities. But the process was no longer easy and not altogether successful. Regional and new bureaucratic interests were clearly threatening older generational and ideological loyalties.

Concerned about these cross pressures in Chinese political life, Mao Tse-tung used 1965 to assemble like-minded "radicals," identify allies, and map a plan for a "Cultural Revolution." Prepared to destroy the elitism of the bureaucracy if necessary, this new movement would aim at a revival of revolutionary ideals and a fulfillment of their promise to the "Nation Builders," that third "generation" who had matured politically after the 1949 liberation. For these people and their Maoist leaders among the first two generations, the answer to the question, "Who shall hold power"? was clear: the Nation Builders.

Like its predecessor, the Great Leap, the Cultural Revolution aimed at mass participation in the political process. Unlike the Great Leap period, political objectives were given much greater emphasis than economic objectives. And the intergenerational tensions of the movement combined with ideological zeal to inspire an unprecedented explosion of youthful energy and pseudo-religious fervor. At the local level, adversaries sought to settle old scores. All of the most destabilizing impulses in society were encouraged to surface and reveal the very tentative and tenuous nature of prevailing compromises among generational, regional, bureaucratic, and ideological interests.

In spite of military professional concerns with a double external threat from both the north and south, scarce psychic and material resources were lavished on this internal, epic realinement of values and priorities. In opposition to the comfortable balance of power among regional leaders and between Peking and the provinces, a wave of purges unseated hundreds of key officials, both civilian and military, leaving the military finally in temporary control of a politically fragmented and psychologically shaken Party and administrative structure. Ideological purity suffered substantially as contending groups "used the Red Flag to fight the Red Flag"; that is, interpreted Mao's thoughts and central directives to favor their own special interests. Rank amateurs armed principally with enthusiasm invaded thousands of factories and offices to seize power.

Although the most serious excesses of the period had become muted by late 1968, following the formation of the last "Revolutionary Committees" in Sinkiang and Tibet, a realinement of bureaucratic, regional, and ideological interests continued for 3 more years while leaders from the second "Northern Warrior" generation reaped the greatest benefits in career development. The problem of removing the military bureaucracy from local civil management roles was not to be solved quickly. The problem of realining the comparative authority and roles of contending generations, easing out the very young and the very old while retaining the most suitable, if not the best, of the middle-aged was politically sensitive, especially since "expertness" was clearly a more promising criterion for retention than "redness."

The widely respected Premier, Chou En-lai, met the challenge with an inspired campaign of personal and institutional cajolery, promise, and threat. It seems likely that future historians will credit Chou principally with the successful, if hazardous, transition to a new era. The most politically hazardous period began in the spring of 1971, when Chou probably persuaded Chairman Mao that a combination of domestic and international factors argued for an opening to the United States. One by one, powerful military regional commanders were called to Peking, some staying for several months presumably to debate this momentous proposed shift in Chinese policy. Personifying the coalition of forces opposing such a move—regional (pro-South, anti-North), bureaucratic (promilitary, anticivil) and ideological (pro-modernization, antidevelopment)—Lin Piao, the Minister of Defense, called upon old comrades and Korean war veterans to oppose this apparent lunacy. The September 1971 purge and death of Lin and other close associates effectively ended the transition and ushered in a new period of reconstruction.

The 4 years from late 1971 through 1975 were not years of unimpeded progress for pragmatic, professional bureaucrats, despite Chou En-lai's efforts to build a national consensus about the values of cost effectiveness and competence. Opposition to a steady erosion of "radical" political gains during the cultural revolution was inevitable. Indeed, the politics of the entire postcultural revolution period may be seen as a conflict among interpretations of that era. Opposition notwithstanding, four trends received encouragement during this period.

Members of the southern revolutionary generation who had always worked most closely with Yeh Chien-ying, Chou En-lai, Teng Hsiao-p'ing and the so-called Second and Third Field Army factions received renewed support, greater authority and a widening stage on which to exert their waning energies. Their closest proteges among the younger Northern Warrior generation who were ideological or bureaucratic allies enjoyed predictable benefits in assignments to key ministries and military commands.

In regional terms, the northern orientation of the Northern Warriors was encouraged by Chou En-lai and exerted a steady influence on policy toward the U.S.S.R., the United States, defense, resource allocations between development and military modernization, and such issues as Taiwan (delay on any decision), central-regional power distribution (increasing central authority) and foreign economic policy, especially toward the United States and Japan. New appointments to key provincial and military regional posts and shifts among military regional commanders confirmed a trend toward increased central authority.

In bureaucratic terms, rewards for increased specialization and professionalism were encouraged, first by Chou En-lai and then by Teng Hsiao-p'ing, after he was restored to a position of national authority in the autumn of 1973. The removal of senior military leaders from civil administrative posts signaled younger military leaders to focus their energies on professional interests. The return of the most competent party administrators and educators to posts from which they had been purged reflected the elitist preferences of Chou and Teng for experience, competence and hierarchy.

In ideological terms, the waning importance of Maoist slogans and revolutionary, inspirational "Maoism" became evident to even the most inexperienced American businessmen, who discovered that only brief, superficial lip-service to Maoist dicta would often precede serious negotiations carried out along lines of predictable national interest. Statements of principle were thus not allowed to interfere excessively with practical considerations in rebuilding avenues of contact and trade between China and the West.

Needless to say, these developments were not allowed to proceed without complaint and even bitter opposition from those whose generational, regional, bureaucratic, or ideological interests were suffering. A succession of "campaigns" in the press and in party circles inveighed against Confucius, the military, those who would undo the "great gains" of the cultural revolution, the new "capitalist-roaders" and so forth. Soon after the death of Chou En-lai in January 1976, these pressures apparently reached such a crescendo as to demand some accommodation. In a move that surprised most China specialists (most of them having expected Teng Hsiao-p'ing to become premier immediately), Teng was removed from all offices. For the next 8 months, radical values and slogans appeared to be dominant. American visitors in 1976 were often surprised at the vehemence of anti-American postures, especially on such issues as trade preferences and Taiwan. An evident muting of professionalism, especially among the military, and an emphasis on the militia and People's War reflected a seeming return to Maoist principles of defense.

Suddenly, in unprecedented haste, the death of Mao in September 1976 was followed by the arrest of his wife and three of the principal leaders of the radical, more youthful elements of Chinese politics. The new premier, Hua Kuo-feng, a northerner and the personification of new trends among bureaucratic, regional, and generational interests outlined immediately above, moved cautiously to reinstate Teng Hsiao-p'ing, worked out apparently acceptable lines of authority and priorities with the most powerful military leader, Yeh Chien-ying, and embarked on a further rationalization of the Chinese political system.

That process was still in train in mid-1978. Its pace, style, and short term consequences for a host of policy issues would be deeply dependent upon the success of the Chinese economy. Indeed, it was likely that the next turn in the drama of Chinese domestic politics would be fundamentally dictated by Chinese economics; for the post-1971 "Consumer Generation" was demanding an increasingly large share of the benefits of the economy. Against those demands, leaders would have to measure the claims from a professionalizing military, a hungry industrial plant and a lagging agricultural system. Whether or not those competing claims for resources could be satisfied while also sustaining a relatively stable compromise among jealous political interests remained the nexus of the political challenge for Hua and his colleagues.

CURRENT POLITICAL ISSUES

Opposition interests in China bided their time in 1978 while the Hua regime tackled seven major political issues, three on the home front and four abroad.

At home, a compromise resolution of the issue of power between central and provincial leadership remained to be found. To leave matters as they had been in early 1977 would be to relinquish central authority over such matters as local and regional internal security policy and key appointments. However, to attain greater central authority might require further purges of incumbent followers of "The Gang of Four." This issue is only marginally complicated by the ongoing shift of power from pre-World War II leaders to post World War II leaders. Thanks to the purges of the cultural revolution and the subsequent realignment of power among generational interests, by 1978 many local, regional and national elements of the political game in China were already substantially in the hands of post-World War II "northerners."

However, if Hua fails to move effectively in 1978–79 to exert more disciplined control over still unruly or independent-minded provincial leaders and military regional commanders, the achievement of effective resource mobilization, including effective taxation and economic planning, improved incentives for both factory workers and farmers (see below), and effective mobilization of China's best qualified youth for technical education could be thwarted. In 1978–79, nationwide working compromises over those subissues would remain a function of the ability of the center to work its will on lower level political leaders. To the extent that the central, and relatively pragmatic, coalition under Hua and Teng fail to persuade or coerce regional leaders to adopt and apply their own informing principles and bureaucratic procedures, continued regional instability might be expected, with negative consequences for productivity and a unifying national consensus under civil control.

In the face of domestic political and foreign military threats, the issue of the role of the military in China's domestic political system was moving toward resolution in 1977 but still remained of critical importance in the second year (1978) of the post-Mao era. If Teng Hsiao-p'ing could have his way, in keeping with his lifelong attitude toward the proper role of the professional military in the social order, the criteria of professional competence and combat effectiveness would probably govern a revolutionary purge of the oldest generation in favor of the group we have called the Northern Warriors. Calculated to streamline the entire military establishment and sharply reduce the manpower surplus of revolutionary military "generalists" in favor of more technically competent "specialists," such a purge would also define clearly the restricted role of the military in domestic politics. This crucial phase in the modernization of the military high command would have to precede any significant hardware modernization designed to improve the PLA's ability to shoot, move, and communicate. But such a housecleaning would forever put to rest any illusions about the PLA as a people's army since it would publicly accent its competence in military technical, not political ideological, terms.

Given the obligations of both Hua Kuo-feng and Teng Hsiao-p'ing to senior military leaders, especially Yeh Chien-ying, "modernization" and a more restrictive role for the military may continue to face serious problems of timing. It is noteworthy that the relatively small number of military representatives from the provinces to the latest Peoples National Congress (February 1978) could evidence an emerging consensus among senior civil and military leaders about military noninvolvement in local politics.

Needless to say, should that consensus fail to materialize—possibly on grounds that Chairman Mao would have disapproved of such a limited role for the PLA, once touted as the "great school of revolution"—then prospects for political stability might suffer. It seems likely that the relatively well qualified officers of the Northern Warrior generation of military leaders might prefer the professional role envisaged by Teng Hsiao-p'ing. But Teng's own generation, still dominant at the very top of the civil and military hierarchy, could delay reform and even insist on a return to a more influential role for the military should social and political cohesion in China appear to be threatened by developments in the economy and in the third domestic political issue of incentives.

At the heart of the Great Proletarian Cultural Revolution was the issue of political and material rewards and how they should be allocated. "Who shall hold power?" was the burning issue for debate and evoked bitter and violent confrontations between "haves" and "have nots." Should a privileged class, especially the sons and daughters of an influential elite, be given preference in educational and job opportunities? Or should the principle of egalitarianism govern admission to such opportunities? While both the center versus the regions and the role of the military are issues that reflect the continuing debate along regional and bureaucratic lines, with ideological overtones, this issue is primarily ideological, with generational, regional, and bureaucratic overtones.

Apparently determined to reform the process of selection for higher education and job assignments along lines of competence rather than along lines of class "justice" and ideological fervour, Teng Hsiao-p'ing and Hua Kuo-feng moved firmly in this arena through 1977 and made their preferences very clear. Unless a substantial reform in 1978–80 in the entire incentive structure—starting with education, continuing with professional and trade assignments and ending with material and status rewards—is initiated over the next 2 years, the pragmatists will probably have to accept disappointments in rates of economic specialization, scientists and technological innovation, and economic modernization—unless shortfall in requisite skills could be imported.

However, if radical "achievements" during the 1966–68 cultural revolution on behalf of deprived "have nots" among China's 700 million rural dwellers were abruptly reversed, the new 1977–78 policy apparently favoring urban and better educated youth, the radical opposition would have a tailor made issue and a potentially irresistible following with which to counter prevailing conservative initiatives.

Dissatisfied regional military leaders could draw on the same spirit to resist central directives and thwart goals of economic development and political unity.

This issue thus remains a central dilemma for the current leadership in Peking and will probably not enjoy satisfactory resolution during the next 3 years. Short run "quick fixes" in such matters as rural private plots, pay scales, school grading and promotions, et cetera, will reflect central elite preferences for material incentives without permitting or encouraging public abrogation of Maoist egalitarianism as the ideal.

In the international arena, China's relations with the three major powers of Asia and the third world constitute the four foreign issues that will continue to test the viability of the Hua-Teng regime.

Given the critical dependence of that regime on domestic economic development, the leadership may be expected to pursue most vigorously those diplomatic and economic relations most likely to foster attainment of domestic economic growth. In that context, relations with Japan deserve the greatest scrutiny because they are moving with the greatest promise. A trade agreement with Japan in early 1978 provided for an encouraging array of imported technologies and resources, including yen loans. Remaining to be resolved was a treaty of peace, the key to which was disagreement over a clause regarding "hegemony" in the Far East. The Chinese leaders were against "hegemony" in the hands of any power, a position curiously reminiscent of the historic American preference for the pattern of power in Asia. Perceived by the Japanese to be a joint declaration of opposition to Soviet aims and initiatives in Asia, the antihegemony clause may yet be included in a peace treaty with China. Without it, Chinese leaders fear that the Japanese will bend to Russian pressure. Fearful of a Japanese "Munich mentality," the Chinese have urged American visitors to shape U.S. policy toward the Far East in order to reinforce Japanese will and moral purpose.

Those signals in 1976–77 from China to Japan reflected a Chinese desire to draw even more heavily upon Japanese technology and economic genius at risk of antagonizing domestic opposition groups as well as the Soviet Union and possibly even the United States. Should cautious policies in Japan in 1978–80 seek to reduce Japan's economic—and political—exposure in China, thus frustrating the current Chinese regime's apparent preferences for closer relations, negative economic and political consequences could follow for China. Depending upon the availability of requisite technology from Western suppliers and Western markets, China might be able to maintain planned rates of growth and sustain a growing political image of Sino-Japanese-American parallel interests. But a failure to sustain such an image as the promised reward for the new opening to the West, combined with domestic economic shortfalls, could provide new opportunities to radical leaders in China and could reinforce other stimuli to revived radical policies.

In the dynamics of that equation between Japan and China, the American role in the Far East is clearly critical. "Normalization" of relations between the PRC and the United States is also a domestic political issue in China because it symbolizes the foreign policy initiatives of the current regime, aimed at China's enhanced political and economic status. If American initiatives toward the Far East generally and toward China directly fail to fulfill some of those aims, whether through recognition of the regime or through conferring real military-political or economic benefits without recognition, the credibility of the Hua-Teng regime at home may be expected to suffer some, possibly fatal, erosion.

Near-term relations between the United States and the PRC thus have some significance for the stability of the Chinese domestic political stage even though immediate economic benefits from MFN and other American economic moves might not substantially improve economic performance. If the image of Sino-American cordiality and "progress" can be sustained, implying probably "normalization" in due course, reflecting potential real growth in economic benefits to the PRC and deterring Soviet adventures along China's borders and among contiguous states, the Hua-Teng regime may disarm opposition criticism and avoid domestic crisis over Taiwan.

The factor of deterrence of Soviet intimidation and military adventures is linked directly with the potential performance of China's economy. If relations with the Soviet Union cannot be maintained by the current regime's foreign policies at levels of confrontation well short of hostilities, valuable resources would have to be diverted to defense. The dilemma for Hua and Teng in 1978 was clear. Some emphasis on the Soviet threat might assist them in mobilizing China's political and economic resources under tighter, central control. It could also enhance values of professionalism and military modernization. But too much emphasis on the Soviet threat could provide younger Chinese military leaders with arguments for heavier diversions of resources from economic development to national defense, potentially delaying economic growth, frustrating consumer expectations, and stimulating political divisiveness and instability.

Such a dilemma is not easily resolved but can only be maintained in some balance. The cost of maintaining that balance in 1978–80 might be significantly reduced for the Hua-Teng regime if the larger structure of power in Asia imposed systemic deterents on the U.S.S.R. as well as other states in Northeast and Southeast Asia. Such an environment might prevail—at least for the short term—if confidence in regional economic growth and political stability were reinforced by evident American presence and will, even though those ingredients might not directly support China's ambitions for reunification with Taiwan. In their discussions with American visitors through 1977 and in internal debates, the position of the conservative coalition in Peking seemed to reflect the hope that American presence and resolve would continue, in both Europe and the Far East, to hold Soviet "social imperialism" at bay. China's contribution to that process would be primarily moral and rhetorical, her resources being focused on the hard domestic issues of economic development.

The fourth and last foreign policy issue for the leadership in Peking in 1978 concerned China's relations with the Third and Fourth Worlds, the less developed majority of the world's states. Traditional ideological categories argued for Chinese support of these regimes against their continued "exploitation" by former colonial powers, exploitation now allegedly being expressed through manipulation of world commodity prices and consumption of raw materials without commensurate rates of economic growth among the less developed suppliers. For the conservative leadership in Peking, how far could they reasonably push that theme while still urging European unity in resisting the Soviets? The West's capacity (and that of Japan) to contend with Soviet aggressiveness in a spirit of unity must be closely related to Western and Japanese economic health. Should competition for either markets or resources begin to seriously erode Western political unity, China might find her own burden of defense intolerably increased.

In brief, China's immediate stake in the industrial West's economic prosperity and political stability was high. In practice, China's representatives in Africa, Southeast Asia, and Latin America were discovering that China's interests frequently paralleled those of the United States and other industrial powers. The outcome of conflict in Angola, Somalia, and Cambodia, to name three cases, might favor Soviet interest at China's expense. China's new leaders were thus learning that a power with interest in the benefits of a healthy global political-economy could not always apply ideological and security policy principles at home and abroad with uniformity or consistency.

A SUMMARY OF CHINESE POLITICAL PERSEPECTIVES

In the immediate aftermath of Chairman Mao's death, China's leaders in 1978 had no reason to modify traditional perceptions of the priority of issues, namely, that domestic political and economic issues are the governing determinants of China's allocations of political and material resources. Foreign issues must come second and must usually be exploited to serve domestic interests.

Among those domestic issues, the health of the economy in 1978–80 and its capacity to satisfy an increasingly impatient coalition of claimants loomed as the dominant general issue. Should the policies of the Hua-Teng regime fail to achieve a balanced response to the expectations of those claimants, both political instability and economic shortfall might ensue. However, a brief convergence of generational, regional, bureaucratic, and idological interests in the immediate post-Mao years suggested that such a balanced response might be feasible, provided that the foreign environment did not introduce countervailing pressures, whether political or economic, to preclude Peking's attainment of a new equilibrium among contending forces.

Guided at home by a search for "moderate" policies, abroad the regime likewise sought means for defining and maintaining an appropriate "political distance" between China and the three major Asian powers. In that endeavor, China's leaders clearly had fewer levers and resources at hand than they had at home. Abrupt changes in the perceived structure of power in Asia or the process whereby crises might be resolved could upset China's economic plans through the workings of the domestic political process. Radical opposition might use such change to mobilize a new coalition of power among impatient younger military leaders, frustrated rural youth and idealists threatened by Teng's new class of professionals to demand still another turn of China's political cycle.

In the light of the past 25 years of change in China, the odds seemed to favor such a shift in Chinese political style before 1980, probably having the effect of constraining the authority of central leadership, increasing the role of the military both in Peking and in the provinces, accelerating military modernization with a consequent delay in the achievement of economic goals, and bringing another round of domestic political instability. Unless foreign powers were willing to commit substantial political and economic resources, such changes on China's domestic political stage could not be influenced very much by any single power's Asian policies. Only Soviet determination to go to war with China or American determination to support China in such a war might overwhelm the otherwise independent dynamic of China's internal political system.

Conversely, internal political developments in the Peoples' Republic of China might profoundly disturb the political equilibrium of all Asia and challenge the leaders of every state to reexamine their stake and their opportunities in the Asian power game. A China committed to its own internal development through a strategy of political compromise among competing interests might reassure other Asian powers, including the U.S.S.R. and the United States, that China would and could play a responsible role in the Asian political and economic system. But a strategy of political confrontation within China could excite opportunists in contiguous states and introduce an era of spreading insecurity across Asia in the early 1980's. In 1978, the choice still rested among a few Chinese political leaders whose success or failure would be measured increasingly by economic statistics.

THE CHINESE DEVELOPMENT MODEL*

By Alexander Eckstein

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Introduction

China's economic performance—based on the criteria of growth and stability—and the elements shaping it were appraised in the preceding chapters.* The role of the past in conditioning ideological predispositions, in imposing resource constraints, and in shaping institutional arrangements was explored in chapter 1. This legacy combined with the prevailing ideology defined the goals and to some extent the policy and institutional instruments chosen for their implementation. This in turn required a far-reaching transformation of economic institutions to assure a high rate of resource mobilization and control over resource allocation. The latter issues were explored in chapters 3 and 4.

To what extent can the combination of ends and means, objectives and instruments, used by the Chinese in the course of their economic development during the last quarter of a century by characterized as a distinct development model? What are the key elements of this model and is it transferable either as a whole or in part to other underdeveloped areas? These are the questions to be explored here based on the different strands of analysis in the earlier chapters.

It would be misleading to think of the Chinese development model as a static, frozen, unchanging system. On the contrary, as was indicated in chapter 2, the Chinese have experimented with three or possibly four models since 1949. The original First Five-Year Plan strategy based on a more or less Stalinist development pattern was gradually modified through a process of trial and error until it evolved into the model associated with the 1970's, that is, the period since the Cultural

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*The occasional references in this paper to earlier chapters and tables apply to Professor Eckstein's book, *China's Economic Revolution,* not to this publication.

Revolution. The focus throughout this chapter will be on this particular post-Cultural Revolution phase of China's development, recognizing that it too is bound to change in the future under the impact of leadership and policy shifts on the one hand and economic transformations generated by the very process of economic growth and structural change on the other.

This exploration of the currently prevailing model will proceed in steps. The goals and objectives of the post-Cultural Revolution regime will be examined first. This will be followed by an analysis of (1) the country's factor endowments and how these have conditioned the strategy adopted, (2) the incentives and institutional mechanisms used to mobilize and allocate resources consistent with the goals and the strategy adopted, (3) the economic performance generated by the interplay of objectives, strategies, and factor endowments, (4) the extent to which one can speak of a distinct Chinese development model and its applicability to other less developed countries, and (5) the dilemmas posed by the development approach adopted in the 1970's.

Objectives

The late Premier Chou's statement to the National People's Congress in January 1975 that China wants to build a powerful modern socialist country by the end of this century probably encapsulates Chinese Communist objectives in their clearest and most succinct form. The pursuit of power requires rapid growth of the economy as a whole; more specifically it requires rapid industrialization, with particular emphasis not only on military goods but also on those branches of industry that serve as inputs for defense production such as steel, fuel, and machinery.

However, rapid industrialization carries with it certain implications for agricultural development. An expanding population and labor force must be fed, a growing industry must be supplied with agricultural raw materials, and imports of machinery and other types of industrial equipment must be financed through exports. A developing country such as China could, if it wished, follow a quite open foreign trade orientation based on the principle of comparative advantage. That is, it could specialize in the production of certain types of farm products for which growing conditions are particularly favorable, use these both for home consumption and exports, and rely on imports to meet a significant share of food-supply requirements. While the Chinese import some foodstuffs, as shown in chapter 7, these are marginal. Major reliance on imported farm products would violate the principle of self-reliance enunciated on many occasions as a major objective in addition to those mentioned by Chou. In the Chinese view, a foreign trade oriented farm policy would expose the country to the risk of sudden supply embargoes, rendering it thereby vulnerable to foreign pressures.

All of this means that agricultural development cannot be neglected lest it hamper and retard industrial growth. For essentially the same reasons consumer-goods production cannot be neglected either, even though it may be assigned a lower priority than expansion of producer-goods output. Increases in the output of textiles, daily necessities, other wage goods, and even some semi-luxuries (for example radios, watches, bicycles) are called for in part to keep pace with population growth and in part to permit at least a modest rise in the standard of living. Such increases are necessary as incentive measures for the labor force and as a means of sharing the fruits of development with the population at large.

The meaning of "modern" as used by Chou En-lai in his report to the National People's Congress is far from clear. This is not too surprising. Industrialization automatically implies a certain measure of modernization. At the minimum it implies a gradual spread of modern technology in industry and transport and also, although at a slower pace, in agriculture. It also means the rise of an army based on modern weapons, the spread of literacy, better health care, and the spread of modern science and its application to agriculture and industry.

However, the application of this concept to the process of production raises a number of dilemmas that have plagued Chinese policy makers throughout the history of the People's Republic. They also plagued Chinese statesmen and modernizers in the nineteenth and twentieth centuries. In the contemporary Chinese context the commitment to modern technology has to be reconciled with simultaneous commitments to "walking on two legs" and to the relative importance of being "red" versus "expert."

A key programmatic slogan of the early modernizers was: "Chinese learning for its fundamental principles (or its fundamental value) and Western learning for its practical use (or practical application)." In a basic sense one could similarly sum up Mao's value orientation and that of most of his associates as a counterpart of this. One could perhaps paraphrase it as "Marxist-Leninist-Maoist learning (or ideology) for its fundamental principles and modern technology for its practical application."

The dilemmas thus posed are clearly reflected in the meanings and connotations associated with the Chinese word *yang* which can be interpreted as "modern, developed, strong," and as such it is a goal to be achieved. But it also suggests "foreign, alien, westernized" and as such may be associated with the restoration of capitalism, revisionism, and a feeling of inferiority as compared to technologically more developed economies and societies.

In contrast, *t'u* is or can be translated as "native, indigenous" and as such is identified with the common people of China, with the masses, and thus represents a positive value. But it can also mean "backward, primitive" and as such is a phenomenon to be overcome, to be conquered.

Perceived from this vantage point "experts" are to be prized; but this is coupled with a lingering suspicion that they are expert in "modern" and therefore "foreign" technology. They are divorced from the masses and tend to look down upon the cruder, more backward, and primitive methods used by them. Therefore, in Chinese Communist perceptions there may be some association between "red" and "native" on the one hand and "expert" and "foreign" on the other.[1]

Regardless of how interpreted, the pursuits of power and modernity are, of course, not unique to China; these objectives are shared by many other developing countries imbued with a strong sense of nationalism.

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[1] This juxtaposition of *yang* and *t'u* and its possible meanings, connotations, and significance is based on a seminal paper by Lyman P. Van Slyke, "Culture and Technology," prepared for a conference on *Sino-American Relations in Historical and Global Perspective* (mimeo), Wingspread, Wis., March 1976.

However, the combination of power and modernity with a strong commitment to socialist values and to the spirit of self-reliance lends China its peculiar distinctiveness as a development model.

From the standpoint of the Chinese Communist leadership one of the most crucial aspects of socialism is the striving toward egalitarianism. There has been no pretension that egalitarianism has already been attained, but there was a determination by Mao and some other leaders as well, especially after the Cultural Revolution, to avoid programs and methods that lead away from rather than toward this ideal. Therefore, measures that may speed industrialization and modernization but contribute to a widening of income differentials encountered resistance. Similarly, the pursuit of socialism without regard of its impact on economic growth was also likely to be opposed. At any one time and in a specific situation there may be definite trade-offs between these two sets of objectives. Some leadership figures and cadres may be expected to assign a higher priority to growth and modernization in a particular situation than to egalitarianism and/or self-reliance. This leads to periodic shifts in policy as leaders are realigned and their power and influence either waxes or wanes. Such shifts may also occur as perceptions of key policy makers change over time and in response to changing conditions.

At least on Mao's part, the pursuit of egalitarianism involved a constant struggle against the rise and crystallization of a "New Class." However, many elements of the bureaucracy are anxious to protect their power and privileged position. Moreover given Mao's adherence to the principle of "democratic centralism," reduction of status differences did not mean a dispersion of political power, even in his own mind. This has led to ambiguities and a series of built-in contradictions, which have become the source of a multi-dimensional struggle. In the course of this struggle, some elements emphasize the "democratic" aspects involving mass participation and the reduction of status differences, while others stress "centralism," that is, the need to concentrate power.

This continuing struggle is also reflected in periodic drives to compress the wage structure and to narrow wage and salary differentials. The 1975 campaign against "bourgeois rights" was in part directed at these income differentials both in industry and agriculture. In agriculture this is to be accompanied by reducing and eventually abolishing the private plots, by gradually substituting the brigade for the team as the basic unit of accounting and income distribution in the commune, and by developing the backward areas.[2]

It is far from clear to what extent such compressions in income differentials narrow the scope of material incentives and thereby undermine work effort and the pursuit of higher skills and labor productivity. In the absence of firm evidence to the contrary, it could be argued that even if differentials were narrowed but not eliminated they could still serve as incentives, particularly if material rewards are supplemented by psychic appeals. Therefore, the narrowing of income differentials—depending on how far it goes in the direction of leveling—need not in and of itself retard industrialization and modernization.

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[2] This was clearly brought out in Vice-Premier Hua Kuo-feng, "Summing-up Report at the National Conference on Learning from Tachai in Agriculture," *Peking Review*, vol. 18, No. 44, Oct. 31, 1975, pp. 7–10, 18. This was a high-level conference concerned with agricultural policy and agricultural development strategy convened for a whole month in September-October 1975.

As noted above, even Mao and his closest allies recognized that "democratic centralism" requires concentration of political power at the top. However, they wanted to prevent differentiation in power, role, function, and income from becoming frozen into status and class differentials. In spite of the Cultural Revolution, this objective does not seem to have been realized thus far. On the contrary, as one travels around China and meets peasants, workers, cadres, and high ranking government officials, status differences are clearly apparent in many subtle ways, such as dress, bearing, deference by others, and many other privileges that surround power positions in all societies.

These are among the considerations that have prompted periodic campaigns to break down the barriers between mental and manual labor on the one hand and urban and rural areas on the other. These campaigns and measures have contributed to a development approach that might be considered characteristic of a Chinese model. This concern with status differences was also one of the reasons for abolishing all insignia of rank in the army and for discouraging too explicit identifications of roles and titles since the Cultural Revolution. These considerations also play a role in the periodic attacks on the technocratic approach to economic, military, and administrative management, on professionalism and expertise in contrast to "redness." They also must have influenced the drive for the expansion of rural small-scale industries. While this is prompted by many other considerations (to be brought out in the next section), it serves to narrow the social and cultural distance as well as the technological and the "modernity" gap between factories and farms, city and country.

These concerns are also reflected in the *hsia fang* (down to the country)—the rustication—movement, which leads to the mass migration of youth from the city to the country. This more or less involuntary movement transfers a relatively well-educated manpower pool to the countryside and thus provides a resource for developing leadership and skill and for raising the educational levels of the peasantry. At the same time it deprives the city of a potential pool of talent and creates on the part of some of this youth a sense of frustration and alienation, brought about by difficulties of adjustment to an unfamiliar and harsh physical and cultural environment.[3]

Perhaps the most significant aspect of the rustication movement is that it reverses the flow of migration normally associated with the process of economic development. Large-scale rural–urban migration under the impact of rapid industrialization caused a great deal of concern in China in the 1950's. The press and official statements were replete with complaints concerning the "blind migration to the cities." More remarkable, and probably unprecedented in contemporary development experience, is the fact that an estimated 12 million young people have been "sent down" to the country from the city since 1968.[4]

However, this movement was not only prompted by a desire to break down barriers between city and country. Chinese planners and policy makers have for some time wanted to check the further growth of their largest cities for a number of reasons. They recognize that urban growth requires large-scale investments in social overhead capital such as schools, hospitals, new housing, and other facilities, none of which are directly or immediately productive. For instance, one of the vice-chairman of the Shanghai Revolutionary Committee told the author in December 1972 that the population of Shanghai city has decreased in recent years; as of that time the population of the city proper was 5.7 million, that is, it was reduced to the 1953 level. He then went on to point out that administering a large city like Shanghai is an enormous and complex task. In his view it would be desirable, but unfortunately not possible, to reduce Shanghai to a city of 2 to 3 million.

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[3] These frustrations and difficulties of adjustment occasionally surface in the Chinese press. They are buttressed by accounts of Overseas Chinese who have an opportunity to visit their native village and by the high incidence of this youth among the Chinese migrants to Hong Kong.

[4] *Peking Review*, vol. 19, No. 2, Jan. 9, 1976.

At the same time, there are a number of indications that while the largest cities have stopped growing, intermediate and smaller cities are continuing to expand. In this way there is a continuum of cities in terms of size, a hierarchy of national, regional, provincial, district, and local centers. This hierarchy facilitates the communication and diffusion of new ideas and influences from above and needs, aspirations, and demands from below. In effect it also serves to narrow the distance between the largest centers and the masses.

The reduction of barriers between mental and manual labor is also fostered by the periodic tours of duty of urban cadres in communes. These tours may range from one to several months of farmwork. However, since the end of the Cultural Revolution they have become more routinized and ritualistic, typically involving temporary duty of at most a few months. They are paralleled by the sending down of agricultural and other scientists to factories and farms to carry on either highly applied research specific to the locality or to adapt research findings to local conditions. Agricultural scientists are thus sent down to the countryside to perform what in effect amounts to farm extension tasks. Similar considerations may lead to the assignment of physical scientists to factories. In the same spirit, as a general rule, students are not admitted to universities unless they have had at least 2 years of experience on farms, in factories, or in the army. Moreover, while studying at universities they are once more assigned to factories for periodic tours of duty. At the same time, so-called workers' universities have been established in a certain number of advanced factories to raise the technical and educational level of the workers.

These measures clearly entail both benefits and costs. They undoubtedly contribute to the more rapid diffusion of advanced methods in factories and on farms. They may also reduce the psychological and attitudinal barriers between manual and mental workers. However, this has almost certainly led to a watering down in the academic and scientific quality of university training since the Cultural Revolution. Available evidence suggests that at least in some fields scientific research has also suffered.

It could be argued that an optimal strategy for an underdeveloped country would be to let industrially advanced countries bear the full cost of advancement in fundamental science and then merely borrow the findings and apply them to local circumstances. While this approach makes a lot of sense, it must be applied judiciously in a large country which is in the pursuit of increasing its power. Thus not all scientific findings travel freely across boundaries. Some have sensitive security implications and therefore may need to be developed by a country such as China more or less independently. But perhaps more importantly the adaptation of scientific findings to local conditions may require considerable scientific capacity itself. For instance, by assigning agricultural scientists to what may amount to extension work, Chinese planners may have contributed to yield improvements in the short run at the expense of the long run. That is, continuing yield improvements in China will require fundamental advances in plant breeding, in farm practices, and in agricultural science. If scientists are in communes instead of laboratories, then the development of agricultural science is bound to be retarded.[5]

In Chinese official pronouncements and statements the goal of self-reliance is usually linked to the pursuit of a "powerful modern socialist country." The self-reliance policy as usually stated in recent years involves "maintaining independence, keeping the initiative in our own hands and relying on our own efforts." [6] In fact, self-reliance as a development objective was already brought to the fore in the late 1950's. However, its salience and importance were markedly increased following the Sino-Soviet break in 1960. It encompasses several concepts and traits, with the prominence and emphasis given to each of these changing from time to time.

Thus self-reliance as an operational policy has been applied in several different contexts and for different purposes. First of all, it can serve as an important source of normative appeals, as can so many of China's long-range objectives. That is, it is used as one of the means for building pride in individual accomplishments by workers and peasants, factories and communes, cadres at all levels, and state organs. In this way it serves as a means of exhortation to maximum effort.

It also can carry with it a strong autarkic connotation. In a national sense it implies minimizing China's vulnerability to foreign economic pressure, particularly in the light of the Sino-Soviet break in 1960. In this sense self-reliance carries with it strong nationalist, exclusionary, and security (defense) connotations. These are explicitly brought out in another of Chairman Mao's frequently quoted directives, "dig tunnels deep, store grain everywhere, and never seek hegemony"; "be prepared against war, be prepared against natural disasters, and do everything for the people." [7]

Self-reliance is also intended to provide a means for minimizing the importation of foreign ideas, influences, and aspirations. In this sense it can serve as one of the means for preserving the purity of China's social system. This leads to minimizing contacts between foreign visitors and their Chinese counterparts—be they businessmen, engineers, and technicians helping in the installation of complete plants; scientists; diplomats; or just plain tourists. Of course, as shown in chapter 7, this policy is not interpreted precisely the same way and enforced with the same vigor at all times. Thus it was interpreted more strictly and narrowly in the later 1960's than in the early 1970's.

However, self-reliance also has many connotations for domestic economic policy, primarily relating to regional and local self-sufficiency. This striving for self-sufficiency is largely rooted in transport barriers and bureaucratic resource-allocation bottlenecks inherent in a central planning system. Both of these stand in the way of supplying local needs. For instance, an American delegation of rural industry specialists visiting China in the summer of 1975 found that "even when communes are prepared to pay the going price for some desired item, it will not be necessarily available and they may get it faster if they produce it themselves." [8] Therefore, even if the manufacture of producer goods by rural industries may initially be high-cost and inefficient, this is likely to be out-weighed by the high costs of transporting raw materials and finished goods over long distances and by the administrative delays in obtaining these products from higher-level organs. These considerations then create strong inducements for the expansion of local industries to meet local, agricultural demand for these products.

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[5] This was identified as a key problem by a delegation of American plant scientists visiting China in August-September 1974; see National Academy of Sciences, *Plant Studies in the People's Republic of China, A Trip Report of the American Plant Studies Delegation*, Washington, D.C., 1975.

[6] Li Chiang (Minister of Foreign Trade of the PRC), "New Developments in China's Foreign Trade," *China's Foreign Trade*, No. 1, 1974, p. 4.

[7] Chou En-lai, "Report on the Work of the Government," *Peking Review*, vol. 18, No. 4, Jan. 24, 1975, p. 25.

The desire for self-reliance is reinforced by other considerations as well, such as the urge to decentralize industrial locations and to develop the more backward regions. As with all of the other objectives and policies discussed above, self-reliance too involves some costs and benefits. To the extent that the objectives spelled out above are actually attained, they can be included in the benefits column of this balance sheet. Depending on how rigidly the policy of self-sufficiency is enforced, it almost certainly entails some sacrifice of the advantages of international and/or inter-regional specialization and division of labor. If these costs outweigh the economic benefits of self-reliance, this would be reflected in a reduction in China's economic growth rate. Furthermore, local and regional self-sufficiency could favor the more advanced as compared to the underdeveloped areas of the country. Consequently, unless there are counteracting policies and tendencies at work, self-reliance policies could lead to a widening of local and regional income disparities.

An attempt to measure the net impact of this policy, the benefit-cost balance, would go well beyond the scope of this interpretative synthesis. Such an undertaking would be fraught with a host of conceptual and statistical pitfalls even if the data were available. Factor and commodity price distortions rooted in China's economic system provide an example of one set of problems. Difficulties of measuring long-term training and learning effects resulting from locating industries in rural areas, or of measuring the impact of such policies on regional income distribution, may serve as other examples. Moreover, even if the self-reliance policy were to lead to some sacrifice of growth it could still be pursued for the benefits it offers in terms of socialist, nationalist, or other goals.

FACTOR ENDOWMENTS

One of the most striking and crucial traits of Chinese agriculture is that it feeds about one-quarter of mankind on about 7 percent of the globe's cultivated land. This necessarily means that the cultivated land area per capita is small, so that China is a very land-short economy. This is greatly accentuated by an acute scarcity of capital—less acute now than 25 years ago—as evidenced by a relatively small capital stock or small annual additions to capital stock per person. This may not be so small in comparison with other less developed countries near the bottom rungs of the world development scale, but it is quite small as compared to the more developed countries.

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[8] American Rural Small-Scale Industry Delegation, *Rural Small-Scale Industry in the People's Republic of China*, Berkeley, Calif., 1976 (forthcoming), Chapter 1, p. 8.

Therefore, the Chinese economy is characterized by an acute scarcity of land and capital and a relative abundance of labor. This was evidenced in the 1950's by remnants of open unemployment in the cities and at least seasonal underemployment in the rural areas, particularly during the winter months. In addition, there must have been pockets of disguised unemployment in all economic sectors. Some of this underemployment was gradually absorbed in the 1950's, as irrigation and other capital projects were introduced in agriculture and as capital plant was rapidly expanding in industry, transport, and other sectors.

However a systematic, conscious, all-out campaign to use labor in order to create capital was not launched until the Great Leap. In this sense the Great Leap represented the first comprehensive attempt in China to substitute on a mass basis a relatively abundant factor for a scarce one. As shown in earlier chapters, this attempt failed due to many errors in planning and implementation. However, the Great Leap concept as a development strategy well suited to China's factor endowments left an indelible imprint on Chinese planners and policymakers. It has been gradually rationalized since, through a process of trial and error.

As a result, we see in the 1970's a whole series of programs designed to convert labor into capital and in a certain sense even into land, that is, cultivated land. However, as these programs expand, more and more labor is absorbed so that labor shortages are becoming pronounced and labor too is developing into a scarce factor, although still relatively abundant as compared to land and capital.

These rationalized Great Leap-type programs of agricultural development (usually identified with Tachai as a model) involve land improvement, irrigation, and generally a marked intensification in the patterns of land use. This involves "*farmland capital construction*" based on "*self-reliance* and hard struggle transforming China in the spirit of the Foolish Old Man who removed the mountains."[9] More concretely, it indeed means reshaping the geographical features of an area to provide the physical conditions necessary for the application of an appropriate mix of other inputs—labor, machinery, fertilizer, and improved seed strains—to bring about high and stable yields. This often requires squaring or terracing the land; at times it involves leveling mountains and transporting the soil manually in baskets for several kilometers to build a huge dam or to cover some areas with top soil. In many areas it means constructing underground drainage channels, reservoirs, canals, irrigation channels, pumping stations, and tube wells.[10]

The major effort in this renewed and expanded movement to learn from Tachai seems to be concentrated in North China, where the water supply has in the past been highly variable, unreliable, and short. Precisely for this reason grain yield per acre of cultivated land has generally been lower in the North than in the South. Correspondingly, the opportunity for raising yields with large investments in land improvement may be expected to be considerably greater in the North. Therefore, it seems that this is the region the Chinese leadership is relying on to raise agricultural output significantly beyond current levels. A larger, more regular, and better distributed water supply combined with improved seeds and more fertilizer could lead to a spread of rice production in the North and a significant rise in multiple cropping per acre.

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[9] Hua Kuo-feng, "Summing-up Report," p. 9.

[10] These major construction projects have been under way for some time. They could be observed during my visit to China in December 1972. They were given a renewed impetus by the National Conference on Learning from Tachai held in September and October 1975 and were described in some detail in American Rural Small-Scale Industry Delegation, *Rural Small-Scale Industry*, Chapter 5, pp. 2–5 and Chapter 6, p. 7.

These massive "farmland construction" projects clearly absorb masses of labor—much of it utilized during the slack season. At the same time, the intensity of land use is also being greatly stepped up in areas that have been traditionally irrigated. More and more of the single-cropped areas are being double cropped and double-cropped areas are being converted to triple cropping. In addition, there is more inter-planting and transplanting of crops that heretofore had not been subject to this practice such as wheat, corn, and cotton. All these measures are designed to increase yields per acre; therefore they are in effect land-saving, but they also absorb a great deal of labor.

Labor is also being claimed by the rapidly expanding rural industries. As noted in earlier chapters these produce fertilizer, cement, farm machinery, bricks, iron and steel, pumps, and other types of equipment needed as inputs in farm production. As a result of all these measures, rural labor seems to be quite fully employed all year round. Moreover, there are repeated signs of marked labor shortages in at least some rural areas and during some periods of the year. This has greatly increased the pressure for mechanizing some of the production and processing operations in farming, particularly those that absorb a lot of labor during harvesting and cultivating time. Thus, the emphasis on selective mechanization of agriculture has been quite pronounced in recent Chinese statements and official pronouncements.[11]

Grain milling provides a telling example of how much labor can be saved even by quite modest measures of mechanization. According to data collected by the American Rural Small-Scale Industry Delegation, hand pounding of rice requires 400 man-hours per ton in some of the places they visited in China. A simple pedal-operated device can do it in 120 man-hours while a commune-run rice mill requires 10 man-hours.[12] Similarly, a lot of labor can be saved by the mechanization or semi-mechanization of threshing; therefore it is not surprising that mechanization has progressed furthest in these two types of operations.

However, the adaptation of production and capital formation technology to the country's factor endowments is not confined to agriculture. It is also quite apparent in Chinese industry, although perhaps in a less dramatic form. In industry it is manifested by the simultaneous application of a spectrum of technologies, based on different factor proportions. This "walking on two (or several) legs" is demonstrated by the rise and spread of rural industries on the one hand and the rapid expansion of large-scale factory industry on the other. At the same time it is illustrated by the simultaneous utilization of both highly mechanized, capital-intensive and preponderantly manual, labor-intensive processes within the same factory, each used for particular operations. But this latter phenomenon is not unique to China. To a greater or lesser extent it is a familiar feature of the development landscape in all industrializing countries.

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[11] A note of urgency concerning the need for farm mechanization is quite pronounced in Hua Kuo-feng's report.

[12] American Rural Small-Scale Industry Delegation, *Rural Small-Scale Industry*, Chapter 4, p. 25.

In this respect the distinctiveness of the Chinese development model is derived from the scale of an approach to "farmland capital construction" and the close integration of rural industrial and agricultural development analyzed in greater detail in chapter 4. In the Chinese case this process of adapting technology to the prevailing factor endowments is carried well beyond the formation of physical capital; it is applied to human capital formation as well.

Perhaps the scarcest resource in China—even scarcer than land and capital—is highly skilled manpower such as scientists, engineers, and medical personnel. This scarcity was of course much more pronounced before 1949, since the supply has been significantly augmented in the past 25 years. In the face of such scarcities, the training and utilization of this type of manpower—particularly the technological aspects of this utilization—can have far-reaching implications not only for economic growth and military security, but also for income distribution and the welfare of the population at large.

Perhaps this can be most clearly demonstrated in the field of health care and delivery systems. In many less developed areas a significant share of the physicians tend to be trained in advanced countries or in medical schools at home that emulate their practices. Frequently this means that the physicians are trained to work with complex and very expensive medical equipment, relying on elaborate hospital facilities and highly advanced methods of health care. Medical personnel thus trained are strongly tempted to reproduce these facilities and practices at home.

Low-income countries, however, can at best afford only a small number of such health care units. This then becomes one of the factors that may lead to the concentration of physicians and health facilities in the cities at the expense of the countryside. In the absence of strong counter-measures, this leads to situations in which the urban upper-income groups are relatively well provided for with medical care while only minimal provisions may be made for the care of the rural masses. Therefore, in low-income countries capital-intensive health care systems tend to favor the rich as compared to the poor.

The Chinese seem to recognize this quite clearly and thus have adopted a strategy designed to produce a mass base for the wide distribution of health care.[13] By training a sizable pool of para-medical personnel, they have built a hierarchy of manpower and facilities ranging from the most advanced in the large centers to the quite simple or even primitive in the villages. However, this does not necessarily mean that complete egalitarianism in health care quality and delivery has actually been attained; it rather means that as compared to the past these differentials have almost certainly been narrowed both inter-personally and inter-regionally.

The same general strategy characterizes the Chinese approach to manpower training and utilization in other fields. For instance, it applies to agricultural scientists and farm extension workers, as indicated above. It is also evident in industry in the technical education provided to workers, thus creating a continuum extending from the highly trained engineer, to the less well trained who are educated in so-called workers' universities, to the skilled worker, and to the unskilled laborer.

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[13] For a sophisticated analysis of the relationships between technology and health care strategy in China see Peter S. Heller, "The Strategy of Health-Sector Planning" in M. E. Wegman, T. Y. Lin, and E. Purcell, eds., *Public Health in the People's Republic of China*, New York, 1973: especially pp. 85–90.

In many ways, the picture presented here is a highly simplified and idealized blueprint, which in its present form is largely the child of the Cultural Revolution. Although some programs can be traced back to the early 1960's, others were introduced only since 1968–69 or even later and thus some have not yet become diffused all over the country. It will take time to train people in sufficient numbers to implement this strategy fully. Beyond this, there are inevitably some costs as well as benefits built into this approach. The recognition of these costs and dilemmas has apparently produced some resistance to the implementation of these programs in universities and scientific laboratories.

In a certain sense the strategy of human resource development adopted in China tries to substitute a mass-based system for an elite-based one. To accomplish this the top of the educational and manpower pyramid is faced with the risk of becoming diluted in several ways. On the one hand, the energies of the people at the top tend to become scattered as they are induced to perform a variety of tasks. They have to spend some time in the rural areas with the masses; often they have to concentrate on highly applied research, development, or extension work rather than on basic research. They also have to devote time to political education and discussion. As a result, their own scientific and advanced technical development may suffer. The scientific and technical advances in their own fields may thereby be retarded.

On the other hand, the educational policies adopted since the Cultural Revolution seriously undermine the possibility of replacing those at the top with equally well trained people. This is due to the fact that admission requirements to universities, including the leading institutions, have been appreciably eased. Elementary and secondary schooling combined were reduced from 12 to 9 or 10 years. At the same time the university curriculum was shortened from 4 to 6 years to 3 or 3½ years. Moreover, university students have to spend some time in factories and on farms and in political education. It may very well be that this system turns out students of greater dedication and commitment—although there is no way of assessing this one way or another—admirably suited to occupy a range of intermediate technical, scientific, and leadership positions. However, it is doubtful that it can produce a generation of high-grade scientists, physicians, and engineers.

This is clearly recognized by many scientists and academicians in China, as evidenced by the fact that these practices have been a subject of continuous debate, with considerable pressure to upgrade academic standards. As a result, visitors to Chinese universities are always told that they are still in a state of "struggle, criticism, and transformation." Based on all these considerations combined it could be argued that the pattern of manpower training and utilization adopted since the Cultural Revolution is well designed to adopt and distribute rapidly technology and knowledge that is well developed. However, this could be at the expense of borrowing from the future in the sense that this strategy, if sustained over a long period, may undermine China's capacity to push forward the frontiers of science and technology.

Institutional Mechanisms and Incentives

The adoption of production and investment technologies designed to implement societal objectives in ways suited to China's factor endowments required the crystallization of a system of economic organization for resource mobilization and resource allocation. It also required a set of incentives to motivate the human actors in the system to contribute to the best of their ability.

Thus farm production was collectivized so as to facilitate consolidation of land holdings, gain economies of scale, obtain more ready access to agricultural produce, accelerate the flow of new ideas and techniques to rural areas, and prevent the rise of a "kulak" class in the countryside. Collectivization did not entail institutional innovation, since it was adopted from the Soviet Union. However, while collectivization in the Soviet Union was preponderantly extraction-oriented, the Chinese were equally concerned about promoting production. But collectives—agricultural producers' cooperatives later transformed into production teams—were too small to manage an integrated approach to agricultural development involving farm production, capital construction, and rural industrialization at one and the same time. This, combined with several other considerations, led the Chinese to bold innovation in the form of communes, which turned out to be counter-productive in their initial and experimental forms; but following a process of trial and error, they seem to have evolved into quite effective instruments for the mobilization of labor and other resources and its allocation to competing tasks.

With the team and the village remaining the basic units of social organization and production, the close links between reward and effort could be preserved. This was reinforced by the continued maintenance of private plots and rural markets, which served to reinforce material incentives. There are definite indications that some leadership groups are pressing for the collectivization of private plots and the simultaneous transfer of the income-accounting functions from the team to the brigade. These measures would inevitably disturb the currently prevailing reward system. How this would affect peasant incentives, if these changes were introduced gradually and combined with persuasion and indoctrination, is impossible to forecast. They would almost certainly be disruptive and counter-productive if introduced suddenly and simultaneously in the country as a whole.

Agricultural collectivization and communization in agriculture were paralleled by nationalization of industry and other non-farm sectors. In this way the state and its subordinate organs assumed direct control over the management of industrial, banking, trading, and other kinds of enterprises. Broadly speaking, in all these sectors the Chinese adopted institutional forms pioneered by the Soviet Union in the 1920's and 1930's. As described in Chapters 3 and 4, these enterprises bought from and sold to each other intermediate and producer goods. They sold consumer goods to households and, in turn, purchased labor from them. All transactions between enterprises and households were in cash, while inter-enterprise payments were made through a system of bank clearings.

Prices of most commodities were fixed and controlled by central or local state organs. Most producer goods and the most essential consumer necessities were subject to "unified distribution," that is, distribution through licensing and rationing. The market as a mechanism for distributing goods and services played a limited and supplementary role. It was used to distribute producer goods not subject to licensing and consumer goods not encompassed by rationing. Within this limited purview, prices played a significant role as allocators of the goods and services distributed through the market mechanism. They also played at least an indirect role in the allocation of goods subject to "unified distribution." That is, prices may have exerted some influence over the particular factor combination and raw materials mix actually used by an enterprise even if these were subject to administrative allocation.

Irrespective of their potential function as allocators, prices served as a basis for valuing all goods and factors and of measuring enterprise performance based on profit or loss accounts. Enterprises turned virtually all their net earnings into the state budget in the form of profits and taxes. The budget, in turn, served as a source of investment finance for all but the locally administered enterprises. These institutional arrangements represent familiar features of economic organization in all socialist countries although there are naturally considerable differences in detail between the Soviet Union, Eastern Europe, and China.

None of these institutions or instruments—in agriculture, industry, and the other sectors—could serve as a means of implementing leadership and societal objectives without a planning system to provide the framework and the direction for this resource-allocating process. Unfortunately, available information concerning the nature and organization of the Chinese planning system is very limited and highly fragmentary, especially for the 1960's and 1970's.

As indicated above and in Chapter 4, it is a system based on a mixture of price and physical-planning elements, combining administrative and bureaucratic command allocation with market allocation of factors, goods, and services. It represents a blend of decentralized and highly centralized traits, combining central control with more or less decentralized administration. Thus, as shown in Chapter 5, central authorities maintain a tight control over budgetary outlays at all levels of government down to the county. This provides them with control over the major sources of funds with which to influence and shape the resource-allocation process.

This control is probably most pronounced in the field of fixed capital investment, since state enterprises are totally dependent on the government budget for financing these. However, communes and sub-comumne enterprises retain their earnings after taxes and thus generate their own investment funds. To this extent the state's control over the pattern of investment is less complete in agriculture than in the other economic sectors. Central control is also much less far-reaching in the allocation of other factors, that is, land, labor, and raw materials.

Thus the patterns of land use are largely locally determined. For non-farm tasks, labor is mostly allocated by provincial, county, and municipal labor bureaus, while in agriculture this function is performed by the communes, brigades, and teams. Centralized and decentralized approaches seem to be combined in the allocation of fuel, power, and materials, although the precise mechanics of distribution and the division of labor between central and local government organs is quite obscure in this field. A certain number of commodities are subject to national distribution. As suggested in Chapter 4, this is probably a smaller number than in the past, possibly over 100 items of great national importance such as iron and steel. This reduction in the number of commodities subject to national materials-supply allocation in itself represents a move in the direction of decentralization.

This tendency is reinforced by the fact that the distribution of all other producer goods and a wide range of consumer goods is delegated to provicial, municipal, and county authorities. There is also a category of goods which, as noted above, are distributed by the market but on the basis of prices fixed by the planning organs. Decentralization is also fostered in China by the considerable transport barriers referred to earlier and by the recognition that a highly centralized system of resource allocation could cause enormous delays in the delivery of goods and in general produce far-reaching inefficiences. These high transport costs and administrative bottlenecks provide local industries with what in effect amounts to high tariff-like protection from potential competition by large-scale urban factories.[14]

Decentralization is further encouraged by the spirit of self-reliance, which exhorts local organs to "take the initiative in their own hands." All these considerations combined induce local enterprises to meet their needs from their own resources or resources already placed at their disposal, rather than wait for additional allocations. Such initiatives are, in turn, made possible by the fact that no enterprise or government jurisdiction is barred from producing any above-plan or outside-plan items as long as it does not lay claim on additional outside resources.

However, decentralized allocation of land, labor, and materials does not preclude *central or national planning and control* over this allocation process. Not only does the budget serve as a powerful central control lever, but the Chinese Communist Party apparatus with its network of cadres reaching down to all enterprises, government organs, villages, and production teams provides a powerful unifying thread. This network provides an *informal channel ofc ommunication and command* through which central authorities can shape and influence the planning process. This informal channel is in part based on *administration by moral example* and on *model emulation* guided by the prevailing ideological precepts and value system.[15] Positive reinforcement is complemented by variousf orms of pressure or coercion. One of the overwhelming impressions one gains from documentary evidence and from first-hand observation in China is that this seems to be a society without an escape. An individual is rarely permitted to retreat into his private self; on the contrary, he is constantly exhorted to participate. Deviant behavior is severely punished, not necessarily through incarceration but by denial of material and other benefits and by what amounts to humiliation, excommunication, and a range of more or less subtle pressures exerted through small neighborhood groups in the city and small work groups in the village.

Moral example and model emulation as a basis for guiding proper conduct are deeply rooted in Chinese tradition and in the Confucian ethic. They have been transformed by the Chinese Communists into potent guides to action. Positive models such as the Tachai production brigade in agriculture or the Ta-ch'ing oil fields in industry are widely publicized. They are combined with negative examples as a means of communicating to the cadres and the masses what is considered approved as compared to anti-social behavior and what practices are to be emulated or avoided. Moral exhortation and model emulation reinforced by education and indoctrination are designed to bring about a convergence in the value systems of the leaders, cadres, and masses. To the extent that they do indeed lead to such convergence in reality they can greatly ease the administrative burdens of central planning and bureaucratic resource allocation.

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[14] I am indebted for this insight to the members of the American Rural Small-Scale Industry Delegation.

[15] For a most suggestive elaboration of this notion of *administration by moral example* see Arthur Stinchcombe's chapter (Chapter 2) in American Rural Small-Scale Industry Delegation. *Rural Small-Scale Industry.* The concept of *model emulation* has been articulated by a number of sinologists, most notably by Donald Munro in *The Concept of Man in Contemporary China* (forthcoming), Chapter 6.

Moral example, model emulation, and normative appeals in general, while important in the Chinese planning process, would not in and of themselves suffice to motivate cadres, workers, and peasants. They need to be supplemented by both material incentives and the more or less subtle forms of pressure referred to above. Actually, the relative weight to be placed on normative appeals as compared to material incentives has been one of the most contentious issues in the policy debates waged during the life span of the People's Republic. In spite of these debates, occasional fluctuation, and pressures, the basic character and structure of material incentives and the reward system as a whole have not changed very much since the mid-1950's.

As noted in earlier chapters, China's industrial wage structure is based on an eight-grade classification which has prevailed since the wage reform of 1956.[16] It provides for a 3:1 to 4:1 wage span, which in some quite extreme cases may go up as high as 5:1. Super-imposed on this wage structure are rates for administrative, technical, scientific, and political cadres which start higher and rise above the top industrial wage. This widens the wage and salary span to about 7:1. At its extremes it may go as high as 13:1 or even 20:1. Clearly, these are quite sizable differentials. However, as will be shown below, there are countervailing forces at work which lead to a narrowing of this span, particularly at the extremes. Moreover, even at its extremes these wage and salary differentials are narrower than those prevailing in Republican China (1911–49) or in many other underdeveloped countries.

Upward movement along this wage scale is apparently based on seniority, skill, performance, and political attitude. Thus, wage and salary differentiation serves as an important spur to better and higher quality effort, that is, to raising labor productivity, unless seniority becomes the predominant criterion for promotion. On the other hand, wages play a very limited role as allocators of labor. This is evidenced by the fact that inter-industry and inter-regional wage differentiation is quite narrow and frequently based on cost of living differentials.[17] It is also borne out by the fact that labor tends to be moved from place to place and sector to sector by assignment rather than by free movement.

In assessing the role of material incentives, it must be remembered that management bonuses have never played an important role in China, in contrast to the Soviet Union and other Socialist countries in

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[16] Carl Riskin, "Workers' Incentives in Chinese Industry," in *China: A Reassessement of the Economy*, Joint Economic Committee, U.S. Congress, July 1975, table 2, p. 216.
[17] Riskin, "Workers' Incentives," Table 3, p. 217.

Eastern Europe. They have not been distributed at all since the Cultural Revolution, and possibly since the 1950's. At the same time, premiums were occassionally distributed to workers in enterprises that fulfilled their plans. It is unclear whether this practice has been continued since the Cultural Revolution.

Conjoined with material incentives, normative appeals are not confined to moral example and model emulation. They are translated into tangible psychic rewards based on many different forms of recognition which carry prestige, special titles such as "model worker," or other types of distinction. Some of these may in addition yield material benefits as well. Psychic rewards may be reinforced by a commitment to "serve the people." Neither documentary sources nor visitors' observations can provide conclusive evidence as to the depth of this commitment by the cadres and the masses. To the extent that this is the case it can serve as a powerful lubricant in the functioning of the planning system and the whole process of bureaucratic resource allocation.

PERFORMANCE

The actual behavior of the development model sketched in the preceding sections can best be gauged by assessing China's economic performance during the past 20 or 25 years. As noted before, China's economic development during this quarter of a century was actually based on several alternative models. However, the basic development approach utilized since the Cultural Revolution can be traced back to at least the Great Leap, and in many of its aspects even to the mid-1950's. The successive models tried represented more shifts of emphasis than totally new departures. Therefore, it may be both legitimate and useful to assess the development experience as a whole, rather than confine this appraisal to the much too brief span of the post-Cultural Revolution years.

Given the objectives spelled out above and in Chapter 2, the most relevant criteria for appraising China's economic performance may be considered stability, growth, income distribution, standard of living, and self-reliance. Each of these will be reviewed here in the light of the more detailed analysis in the preceding chapters.

Economic Stability

As indicated in Chapter 5, the objective of economic stability involves the maintenance of both full employment and a stable price level. It can also be viewed as the unfolding of a reasonably stable growth path associated with relatively mild or minimal fluctuations in output and employment.

In China there was clear evidence of open urban unemployment in the early 1950's when the economy was still recovering from war devastation and was thus operating at less than full capacity. Open unemployment appeared again in the crisis years between 1960 and 1962 or 1963. During the rest of this period China was experiencing no large-scale unemployment. Inevitably there was some seasonal underemployment in agriculture and some wasteful or inefficient utilization of labor in industry and other sectors. For instance, anyone visiting

Chinese factories in recent years must have been struck by the relatively large and often not fully utilized pool of labor one encounters in these plants.

More remarkable than the record of employment has been the course of price stability in China. However, it must be stressed that this finding is based on an official index which may understate price rises of unrationed commodities, although it seems to be borne out by comparisons of samples of commodities and of wages for the 1950's and 1970's. China's performance in containing inflation becomes even more impressive when viewed in the perspective of the country's experience in the past, Soviet pre-World War II experience, and the double-digit inflation raging in the contemporary world.

On the other hand, China's economic development was characterized by marked fluctuations in rates of growth, as shown in Table 6–7. This was most clearly illustrated by the explosive growth during the Great Leap years of 1958 and 1959, and the drastic collapse during the crisis years between 1960 and 1962. There were milder dips during the Cultural Revolution, and throughout the years rates of growth alternatively accelerated and decelerated. For this reason, China's economic performance must be judged as somewhat mixed if based on the criterion of stability. It was remarkable in terms of avoiding the pitfalls of inflation, but it was subject to marked fluctuations in rates of growth—and sometimes even in levels—of production and at times in employment as well.

Economic Growth

In spite of these fluctuations, the growth performance of the Chinese economy can be considered very impressive when compared to that of (1) Republican China (1911–49) or some sub-period thereof, or (2) presently developed countries that were in the process of industrialization between the late 18th and 20th centuries. In contrast, it is less exceptional in comparison with the post-war experience of other underdeveloped areas, particularly in Asia (e.g., South Korea, Taiwan).

As shown in Chapter 6, measurement of growth in China and some other countries as well is greatly complicated by the absence of reliable statistics. However, if we accept the reconstructed official data as a basis for analysis (as summarized in Table 6–7), China's average annual rate of growth between 1952 and 1974 may be estimated at around 6 percent. If the country's GDP estimates were expressed in terms of more recent prices (e.g., 1970, 1971, or 1975 prices), the growth rates would be somewhat lower. Presently, industrialized countries have attained their mid-20th century level of development with an average rate of growth which, in most cases, was not much above 3 percent per year. It is of course true that these countries started their industrialization process in the late 18th and early 19th centuries at a level of per capita income probably higher than that of China today. Even so, it must be remembered that a 3 percent rate of growth produces nearly a twentyfold increase in GNP over a century; a 4 percent rate yields almost a fortyfold rise; and a 6 percent rate leads to an increase of over 300 times in a century.

One cannot sufficiently emphasize the fact that growth rates of 4 to 4.5 percent, which appear moderate by contemporary standards, were characteristic historically of the most rapidly expanding and dynamic economies. This is the rate that transformed Japan into a major industrial country between 1870 and 1940. If China were to grow at the same historical rate as Japan (about 4 percent), then its GNP would be approximately 14,000 billion yuan (at constant prices) in 2075 as compared to an estimated 350 billion in 1975. At today's exchange rates, Chinese product would be approximately equivalent to U.S. $7,000 billion; that is, close to five times the 1975 GNP level for the United States. This would necessarily mean that China would be an enormous economic power, at least in absolute terms. Whether this would also be true in a relative sense will necessarily depend on what happens in the coming century in the United States, the Soviet Union, and Japan. Indeed, if these countries follow their past growth patterns, the gap between them and China will increase, rather than diminish. All this, however, constitutes a very artificial projection, given the enormous imponderables of China's and these other countries' future. Therefore, it is only intended as an illustration of what may be the implications of a 3 to 6 percent growth rate over a century.

Income Distribution

Having explored in some detail the problems of stability and growth in Chapters 5 and 6 and more briefly above, it is most essential to review some of the fragmentary evidence concerning income distribution in China. Direct quantitative measures of China's income distribution are precluded by the lack of relevant statistics. Nevertheless, it is possible to illuminate this question, at least partially. For this purpose three kinds of information are presented in this section. First, some data on the comparative wage structure of China and certain other countries are discussed and analyzed. Second, the implications of the income redistribution resulting from land reform, collectivization, and nationalization are analyzed in somewhat hypothetical terms. Third, the trends in inter-regional per capita product differentials are assessed as a possible means of illuminating changes in income distribution between the 1950's and the 1970's.

One of the most striking characteristics of Chinese society as seen by virtually any visitor is its apparently egalitarian character in terms of income. As one travels around China, be it in the city or in the countryside, one sees poverty but very rarely abject misery or degradation, so frequently associated with the extremes of deprivation. One certainly has the impression that the Chinese have succeeded in placing a floor on real incomes. Firsthand visual impression, at least in areas to which foreigners have access, also shows that people seem well fed, adequately clothed—at times with a relatively narrow band of differentiation in quality of dress, be it men or women. This impression is reinforced by the fact that one very rarely is exposed to extremes of luxury and high living. It is also particularly striking if one has been to India or some other parts of Asia.[18]

More tangibly, however, during a month-long visit to China, it is possible to collect wage and salary data, as did a group including the author in December 1972 and January 1973. The data thus gathered in factories, local industry, schools, universities, and other institutions suggest certain patterns. It became clear that the wage span of industrial workers in factories varied from about 3:1 to 5:1. Based on an eight-grade classification, industrial wages would usually range from about 30 yuan to 100 or 120 yuan a month (as illustrated in Table 8–1) to which were added certain payments in kind. Similar data were gathered by other visitors and can also be confirmed from evidence in Chinese documentary sources.[19]

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[18] For instance, I recall my first visit to Hong Kong in December 1952, when I saw many people homeless, sleeping in the streets, or inhabiting miserable squatters' settlements on the outskirts of Kowloon. (This, of course, no longer applies to Hong Kong today.) Similar impressions, even worse, could be gathered on a visit to Calcutta or some other parts of India in 1966. I saw nothing even remotely corresponding to these symptoms in any part of China visited.

TABLE 8–1.—MONTHLY WAGE IN TWO CHINESE FACTORIES IN 1972

Grade	Wage in yuan	
	Shenyang No. 1 machine tool plant	Anshan rough rolling mill
Apprentices	22.00	19-21
Workers' grade:		
1	33.00	34.50
2	38.90	40.00
3	45.80	48.13
4	54.00	56.82
5	63.60	67.10
6	74.90	79.25
7	88.20	84.50
8	104.00	110.00

Source: A. Eckstein, China Trip Notes (mimeo), Ann Arbor, Mich., December 1972 and January 1973.

A very similar wage structure was encountered in a Shanghai textile mill, in a pottery factory near Canton, and in several factories in Nanking. The average wage in these factories was given as 60 to 70 yuan a month, that is, within Grade 5 and closer to the bottom than to the top of the scale. Interestingly enough, this range of wage differentials is quite typical for industries in many other countries, both developed and underdeveloped. For instance, in Guatemala the ratio of average hourly earnings of electrical fitters to laborers was 7:1 in the early 1960's. The ratio of carpenters' wages to unskilled laborers' in construction was 5:1. In Singapore, the ratios between government skilled and unskilled rates was 2.5:1. In Egypt, average weekly earnings of semi-skilled workers in all industries were more than three times as high as unskilled earnings in 1960.[20] In the United States and Europe, the wage spread within industry seems to be typically around 3:1. All these examples suggest that the Chinese industrial wage structure is not significantly more egalitarian than that of other countries. Yet this conclusion must be treated with caution since many of these wage data are not fully comparable.

For technical and engineering personnel, the salaries would usually start at about 50 to 80 yuan and go up to 150 to 200 yuan a month. For instance, a chief engineer would frequently be in this top range. However, for very senior management, technical, and professional personnel, including senior full professors, we were quoted salaries of 300 to 400 yuan. This suggests that a wage and salary span of 10:1 can at least occassionally be found in China. Moreover, if we compare the polar ends of these scales, ranging from an apprentice to that of senior professional or political figures, differentials of 20:1 can also be encountered. There is no doubt that the number of people in these top ranges must be very small.

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[19] See Riskin, "Workers' Incentives," Tables 2 and 3, pp. 216–217; Christopher Howe, *Wage Patterns and Wage Policy in Modern China, 1919–72*. Cambridge, England, 1973, Chap. 3; Charles Hoffman, *The Chinese Worker*, Albany, N.Y., 1974, Chap. 4.

[20] Elliott J. Berg, "Wage Structures in Less Developed Countries," in A. D. Smith, ed., *Wage Policy Issues in Economic Development*, London, 1969, p. 303.

What would this mean in terms of U.S. equivalents? According to the *Handbook of Labor Statistics*, the average farm wage rate in the United States in 1972 was about $360 per month.[21] The lowest union wages quoted in the same *Handbook* were $2.11 per hour for truckers' helpers in Birmingham, Alabama. Translated very crudely to an annual rate, this would mean roughly $4,000 to $4,500 a year. Starting with a base rate of $4,000, a ratio of 10 to 1 would call for an income of $40,000 a year and 20 to 1 for an income of $80,000 a year. Since there is no income tax in China, these would have to be net spendable incomes, which according to recent U.S. tax rates for a family with two children would be equivalent to a gross salary of about $160,000 a year. Of course, there are some, but very few, chief executives in the United States who are earning gross salaries and bonuses (i.e., before paying taxes and exclusive of property incomes) of perhaps as much as $500,000 to $800,000 a year.

Therefore, at these very extremes the U.S. wage and salary span may go as high as 50:1 or even 75:1 (on a net, after-tax basis). In most African countries, where the disparities tend to be largest, the ratio between the usual starting salary of a university graduate in the civil service and an unskilled laborer in the capital city was between 8:1 and 11:1 in 1963. In India, the comparable ratio was 5:1 in 1958. However, if we take the top of the scale reached by the numerous graduate cadres and compare it to unskilled labor rates, the differential is much more striking—about 30:1 in Africa and roughly the same in India. In fact, a young university graduate may be paid 10 times more than an unskilled worker, a permanent secretary (the top career in the civil service) 30 times more, and an industrial manager in the private sector 80 times more.[22]

All of this suggests that at the extremes the wage and salary spread in the United States and in many underdeveloped countries is much wider than in China. Of course, if property incomes are added, the gap between China and the other countries becomes even wider. At the same time, the spread in China is significantly greater than one would pre-suppose on the basis of visual observation alone. Of course, wage and salary data in and of themselves do not tell us much about distribution, since we do not know how many people are encompassed by each income-earning class. Beyond that, wage and salary spreads of 10:1 or 20:1 may represent very differing degrees of real income differential in China as compared to the United States, India, or other underdeveloped countries. One would expect this to be true for a number of reasons. Housing rentals are nominal in China, very rarely exceeding 2 to 4 percent of monthly income. Health services for all factory workers are free and for workers' dependents provided at nominal rates. Prices are fixed in such a way that all necessities are priced very low, while luxury goods are priced very high. As a result, the price structure itself has built into it certain elements of progressivity that tend to narrow the real purchasing power differential between the top and the bottom of the income scale in China. This is further reinforced by the fact that consumer necessities, the purchases of which loom large in consumer budgets, are rationed so that higher income groups cannot bid them away. Moreover, the range and quantity of luxury goods obtainable at any price is quite limited in China. Finally, luxury consumption is frowned upon, particularly since the Cultural Revolution, so that even if the luxury goods are available and people can afford them, they are discouraged from buying them.

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[21] U.S. Department of Labor, Bureau of Labor Statistics, *Handbook of Labor Statistics, 1973*, Washington, D.C., 1973, Table 45, p. 108.

[22] Berg, "Wage Structures," p. 320.

In addition, there are continuous pressures to narrow the wage and salary spread. Thus, workers in grades 1 and 2 are periodically promoted en masse. Monthly salaries of 300 to 400 yuan for senior personnel result from the fact that some individuals were raised to these levels in earlier years and have not been reduced since. At the same time, people now appointed as senior engineers or professors obtain top salaries of around 200 yuan a month. This would suggest that the wage and salary span could be considerably compressed in the future, possibly to 5:1 or 7:1 unless current wage policies are markedly reversed. On the other hand, all the data cited thus far relate to the urban sector, while based on available indications, peasant incomes and wages in the rural areas seem to be considerably lower. If this is taken into account, even if top salaries do not exceed 200 yuan, wage differentials of at least 10:1 may be expected to prevail for some time to come.

One may also assume that people near the top of the managerial, professional, and political-cadres scale also receive sizable perquisites or payments in kind. If these are included, spans of 10:1 may be on the low side. In spite of this, income differentials both in money terms and in real terms are almost certainly higher in the United States or in India than in China. This is of course what one would expect. The purpose of the comparison is not to suggest that the two spans or distributions are comparable but merely to illustrate that the degree of inequality in China is probably significantly greater than visual impression or ideological commitment would suggest. This also implies that the Chinese clearly must be relying to a much greater extent on material incentives as a means of motivating workers, technicians, managers, and professionals than is often sanctioned by official statements. At the same time, in the face of this reality, it is not surprising that Mao and many of his associates see the need for periodic campaigns designed to inculcate egalitarian values as a means of countering inegalitarian trends built into the wage and salary structure.

Nevertheless, although China's wage and salary—and therefore probably also its household income—structure is characterized by considerable inequalities, these are almost certainly smaller than in the 1920's, 1930's, or 1940's. The far-reaching confiscation, nationalization, and collectivization of private property must have led to major changes in the distribution of income between 1949 and 1955 or 1956. As shown by Perkins, even if GDP per capita did not rise appreciably between the 1930's and the 1950's, the consumption levels of the poor could have increased significantly just through this redistribution.[23] Thus, based on hypothetical but not unrealistic calculations and some simplifying assumptions, if the top 5 percent of the population receives 25 to 30 percent of the national income and the bottom half receives only 15 to 20 percent, one can reduce the top 5 percent to the national average and have enough left over to raise both investment and consumption.

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[23] D. H. Perkins, "Growth and Changing Structure of China's Economy," *China's Modern Economy*, pp. 125-127.

This would mean that after the redistribution, the 5 percent who were formerly on top would receive only 5 percent of the national income, while the share of the bottom half would now be 30 to 40 percent. Thus, their incomes and consumption levels could be doubled, assuming that per capita product rose at least marginally between the 1930's and the 1950's; that is, by at least 10 to 15 percent to absorb the additional investment.

There is also some limited evidence that suggests that the process of income redistribution was continuous, not confined to the 1945–55 period. Necessarily, the radical transformation in the income structure was a hallmark of the initial years of Communist rule. Therefore to the extent that there may have been additional changes, these were much more gradual and incremental. The evidence for some further redistribution of income is both qualitative and quantitative.

It seems that while real wages of workers and all employees in industry rose rapidly between 1952 and 1957, they did increase only marginally between 1957 and 1972.[24] There is some evidence to suggest that this virtual standstill in real wages produced some industrial-worker dissatisfaction and unrest during the Cultural Revolution and again in 1974–75. At the same time, agricultural purchase prices were raised almost 65 percent, while the prices of industrial products sold in rural areas have been increased less than 15 percent.[25] As a result, the real incomes of the rural population must have been raised, although we have no clear indications whether the benefits of this improvement were distributed more or less equally between the different elements of the rural population.

Regardless of how they were distributed, this must have led to a compression of average urban-rural income differentials. A possible narrowing of income differentials also seems to be borne out by possible changes in the inter-regional distribution of income. It appears that regional income disparities were quite wide in China, even as late as 1957, possibly wider than in Italy, Yugoslavia, or India. However, available data seem to indicate that these disparities were diminishing, even if only quite gradually, between 1952, 1957, and 1971.[26] It is of course possible that a Chinese province is much too large a unit in terms of which to measure these disparities. Therefore, it is conceivable that these conclusions would be modified if per capita income or product indicators were readily available on a *hsien* or commune basis.

What conclusions can one draw from these explorations of China's income redistribution? Following the birth of the People's Republic a far-reaching program of income redistribution was carried out which must have raised the living standards of the lower-income groups. However, this did not by any means eliminate all income differentials, nor was it so intended. It still left wide disparities between rural and urban areas as well as within each of these broad sectors and between different provinces and regions.

Government policy was directed to a gradual narrowing of these disparities between the 1950's and the 1970's. The tentative evidence presented suggests that wages and salaries were compressed in the urban sector as a whole. Periodically workers in the lowest two grades were raised a grade or two en masse so that at a particular time the number actually tied down in these bottom grades may have been small. At the same time, at least since the Cultural Revolution, the numbers in the top salary scales of 300 to 400 yuan must have diminished considerably through a process of attrition. Concurrently, average urban-rural income differentials were almost certainly narrowed in the past 20 years. On the other hand, it is far from clear what happened to income disparities within rural areas. Finally, inter-regional income differentials were narrowed. At best this could have had only an indirect effect on inter-personal income distribution.

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[24] See Howe, *Wage Patterns*, Table 17, p. 31 and D. H. Perkins, "Growth and Changing Structure," Table A–4, p. 153.

[25] Perkins, "Growth and Changing Structure" and *Peking Review*, No. 31, Oct. 10, 1975, p. 9.

[26] This is based on the findings of Nicholas R. Lardy in "Regional Growth and Income Distribution, The Chinese Experience," Economic Growth Center, Yale University, Discussion Paper No. 140, October 1975.

What then is the net impact of these changes on income distribution? It is reasonably clear that there are still considerable disparities in the mid-1970's within industry, between urban and rural areas, and inter-regionally. However, these dispartities are probably less pronounced than in the mid-1950's and these in turn were significantly diminished in comparison with the mid-1930's. Beyond this, it would not be possible to derive any precise measures of China's income distribution during any of the aforementioned periods due to the paucity of available data.

Standards of Living

Just as with income distribution, data limitations do not permit any hard and fast measurements of China's living standards and their trend over time. However, as with incomes, these may be illuminated at least partially and indirectly.

A very crude measure of trends in Chinese standards of living may be obtained by comparing the estimated products per capita in 1933, 1952, 1957, and 1974 and then deducting from these investment and defense expenditure. The residual would then be a composite of household, that is, private, and collective consumption; the latter referring to health, education, recreational, and similar services financed out of the Government budget. Based on the estimates in Table 6–8, supplemented by Perkin's derivations for 1933, it seems that per capita product may have declined slightly between 1933 and 1952 but by 1957 exceeded former levels. It then continued to grow, with some interruptions. As a result, by 1974, it exceeded the 1957 level by perhaps more than 90 percent.[27]

As shown in the highly tentative estimates presented in table 8–2, per capita consumption may have declined much more substantially than product between 1933 and 1952 and then recovered more slowly. This was largely due to a very dramatic rise in investment, which increased from about 5 to 6 percent of national product in 1933 to about 16 percent or more in 1952 and 20 to 25 percent in 1957. However, by the 1970's average per capita consumption standards had exceeded 1933 and 1957 levels by about 50 and 70 percent, respectively. This suggests that the bulk of the Chinese population must have begun to reap substantial material benefits from the process of economic development. Based on these conjectural estimates, per capita consumption may have risen at an average annual rate of close to 3 percent since 1952, and at a rate of 1 percent since 1933.

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[27] The point of departure for these calculations and those in Table 8–2 was provided by the per capita estimates in Table 6–8. The 1933 estimate is based on Perkins, "Growth and Changing Structure," on the assumption that the rate of change between 1933 and 1952 would be the same if calculated in 1957 or in 1952 prices. Investment, defense and government administration shares in GDP are based on estimates by Perkins, T. C. Liu and K. C. Yeh, *The Economy of the Chinese Mainland;* Kang Chao, *Capital Formation;* and the U.S. Government.

TABLE 8-2.—CONJECTURAL ESTIMATES OF PER CAPITA PRODUCT AND CONSUMPTION IN CHINA, 1933-74

Year	GDP per capita (in 1952 yuan, rounded)	Nonconsumption share (in percent)[1]	Consumption per capita (in 1952 yuan, rounded)[2]
1933	140	10	126
1952	130	20-25	98
1957	160	25-30	112
1974	310	35-40	186

[1] Refers to total investment, defense, and Government administration.
[2] Based on the higher share of these ranges.

TABLE 8-3.—RELATIVE PURCHASING POWER OF AN AVERAGE INDUSTRIAL WAGE OVER A SAMPLE OF CONSUMER GOODS IN CHINA AND THE UNITED STATES

Category	Amounts the average wage can purchase		
	In China	In United States	Ratio (rounded)
	Per hour		
Foodstuffs in pounds:			
Rice (long grain)	2.0	14.2	7:1
Wheat flour	1.8	23.9	12:1
Irish potatoes	4.8	30.5	6:1
Carrots	4.8	12.4	25:1
Cucumbers	5.5	10.9	2:1
Chicken	.26	6.9	26:1
Beef	.48	2.0	4:1
Pork	.34	2.7	8:1
White sugar	.44	20.4	46:1
	Per week		
Fabrics, clothing, and footwear:			
Cotton prints (per square meter)	7.0	129.2	18:1
Corduroy fabrics (per square meter)	2.7	81.9	30:1
Unpadded cotton cloth jackets	1.6	6.4	4:1
Cotton work pants	2.1	26.9	13:1
Corduroy jackets	1.6	5.6	3.5:1
Corduroy trousers	2.3	19.2	8:1
Cloth coats with lining	.2	2.9	14:1
Blue cotton work shirts:			
Good quality	3.2	19.2	6:1
Poorer quality	5.0	33.6	7:1
Cotton flannel colored western-style shirts	2.5	44.6	18:1
Light wool sweaters	.7	10.7	15:1
Men's cotton socks (pairs)	11.3	206.7	18:1
Tennis shoes:			
Basic quality	3.1	33.8	11:1
Sturdier	1.5	21.3	14:1
Cloth shoes with rubber or synthetic soles	2.3	48.8	21:1
Miscellaneous consumer manufactures:			
3-gal pots	1.2	29.8	25:1
Drinking glasses	49.4	1,344.0	27:1
Simple alarm clocks	1.0	16.8	17:1
Very simple bedside lamps	1.3	29.8	23:1
Metal folding chairs	0.7	22.4	32:1
Wooden straight-back chairs	1.5	12.2	8:1
Umbrellas	1.7	26.8	16:1
Ball-point pens	13.8	149.3	11:1
Plastic 4-oz baby bottles with nipple cap	34.6	336.0	9:1
Durable consumer goods:			
Bicycles	.4	9.1	23:1
12-in TV sets	.14	6.5	47:1
Small transistor radios	1.6	84.4	53:1
Watches:			
Swiss	.11	5.9	53:1
Domestic	.54	32.8	60:1

Sources: The figures in this table were derived by the author based on price data for China and the United States. For China these data were collected by Prof. Robert Scalapino and the author during a visit in December 1972 and by Bruce Reynolds on a visit in the fall of 1973. For the United States, they are average 1972 prices based on Retail Food Prices (monthly), published by the U.S. Bureau of Labor Statistics; non-food prices were obtained from Sears Roebuck and J.C. Penney catalogs.

What was the living standard actually attained as a result of this development process? One way of gauging this could be to develop at least a partial measure of the comparative living standards in the United States and in China in the 1970's. Admittedly the consumption patterns in the two countries are so divergent that they may be difficult to compare. However, relevant data in the same form as those obtainable for China are more readily available to us for the United States than for other countries. Bearing these considerations in mind, the comparative purchasing power of an average industrial wage was estimated for China and the United States as shown in Table 8-3.

The comparison is based on retail price quotations in markets, department stores, and other shops compiled by the author during a month-long visit to China at the end of 1972. These were combined with prices collected by a group of economists from Yale who visited China in the early fall of 1973.[28] As a result, a total of about 210 price quotations were gathered for 110 different items. In a number of cases prices for several different varieties or qualities and from several different Chinese cities were obtained.

The Chinese goods for which price data were available were first matched by U.S. equivalents in terms of size, weight, and quality. Only consumer items for which reasonably close equivalents could be found were used. Then the U.S. retail prices for these were compiled. These two steps reduced the number of items from 110 to 38—9 entries for foodstuffs, 15 for fabrics, clothing, and footwear, 9 for miscellaneous manufactured consumer foods, and 5 for durable consumer goods.

The quantity that could be purchased with the average industrial wage at the prices prevailing in China and the United States was then derived. The calculations in table 8-3 are based on an average monthly wage in Chinese industry of 60 yuan. Since there are no income taxes, this is a net wage. In contrast, average weekly earnings of production and non-supervisory workers were $154.69 in the United States in 1972. However, this gross is income. The *Handbook of Labor Statistics* gives the gross weekly earnings of production and non-supervisory workers on private agricultural payrolls as $135.78 in 1972. The corresponding income, net of taxes, for a wage earner with three dependents was $120.79. This 88 percent ratio was applied to the $154.69 figure to obtain a net average weekly wage in U.S. manufacturing of $134.40. This is equivalent to $2.84 per hour, assuming a 40-hour week, and $591.00 a month. If one were to convert the monthly Chinese wage into dollars at the exchange rate prevailing in late 1972, it would be about $24. On this basis the American worker would be earning 25 times more than his Chinese counterpart. As may be seen from Table 8-3, this probably overstates the purchasing power gap.

Table 8-3 shows that for foodstuffs the purchasing-power ratios range from 2:1 for cucumbers to 46:1 for white sugar. For staples, the largest consumption items in China, the ratios range from 6:1 for potatoes to 12:1 for wheat flour. For meats the range is 4:1 for beef, 26:1 for chicken, with pork—a popular consumer item in China—8:1. The median ratio for all foods is 7:1.

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[28] The prices obtained by the Yale group were compiled by Bruce Reynolds who at that time was a graduate student in economics at the University of Michigan and is now Assistant Professor of Economics at Union College.

For fabrics, clothing, and footwear the range is from 3.5:1 for corduroy jackets or 4:1 for unpadded cotton cloth jackets to 30:1 for corduroy fabrics. However, cotton cloth prints were 18:1 and so were several other items. The median was 11:1. In the miscellaneous manufactures category, wooden straight-back chairs were relatively cheapest with an 8:1 ratio, while metal folding chairs were relatively dearest at 32:1. The median of these nine items was 17:1.

The purchasing-power gap was greatest for durable consumer goods, which ranged from 23:1 for bicycles to 60:1 for domestic watches. The median was 53:1. Ideally, one would want to have a much larger sample of observations for each category. Thus, undoubtedly, the small number of comparable items reduces the validity of the generalizations one would wish to make. Nevertheless, the data exhibit a consistent pattern.

The purchasing power of the American industrial wage is a multiple of the Chinese for all the listed items and a sizable multiple for most. The differential is relatively narrowest for foods and widest for durable consumer goods, with fabrics, clothing, footwear, and miscellaneous manufactures between these two in the order cited. This is precisely what one would expect a priori, on the basis of international cross-section comparisons of consumption patterns.

Of course, from these data we cannot derive a single index or derive a single measure of the relative purchasing power of the two wages in their own price settings. However, one is strongly tempted to conclude that the purchasing-power gap is likely to be at least 7:1, since this is both the median for foods and the ratio for rice. Almost certainly this is on the low side in the light of the data in the table. One might speculate that, based on Chinese tastes, habits, and consumption-expenditure patterns, a U.S. wage in manufacturing might buy 10 times the quantity that could be obtained in China. However, based on U.S. tastes and patterns, the purchasing-power multiple could go as high as 20:1 or higher. In making this comparison, one must also bear in mind that the average industrial wage represents a far higher position in China's total income scale than would be the case for the corresponding U.S. wage on our income scales. This is primarily due to the fact that average farm wages and incomes are perceptibly below the average industrial wage in China, while the bulk of the population and labor force is in agriculture and not in industry.

Self-Reliance

As pointed out before, self-reliance refers to two different but interrelated aspects of the economy. The first relates to international trade and the degree of foreign trade dependence, while the second refers to the extent of local or regional self-sufficiency. On the basis of the available data for China, crude assessments of foreign trade dependence are possible but the same cannot be said for regional self-sufficiency. Therefore, this analysis of self-reliance will be confined to the first aspect.

As indicated in Chapter 7, foreign trade is necessarily a small sector relative to GDP in any large continental or sub-continental economy. However, depending in part on which of the estimates is used, it seems that China's foreign trade dependence is low, even in comparison with other large countries. Actually, foreign trade ratios rose in China during the 1950's, declined in the 1960's, and may have been rising once more in the 1970's without recovering to their 1959 peak importance. Under the impact of these contrasting trends, these ratios may not have been too different in 1974 than in 1952. They may have declined slightly, since for this period as a whole GDP seems to have been rising somewhat faster than foreign trade volume, that is, at an average annual rate of 6 and 5 percent respectively.

China's decreasing import dependence is borne out by another series of measures as well. Imports, particularly of machinery and equipment, represent a major avenue for the transfer of foreign technology. Moreover, imported capital goods can play a most significant role as a component in domestic investment. This indeed was the case in the 1950's, when close to 40 percent of China's total investment in machinery and equipment was based on imported capital goods. This ratio was about 6 percent in the 1970's, having declined to around 4 percent during the Cultural Revolution period.[29] During these same years the share of machinery and transport equipment in China's total import bill declined from 35 to 18 percent.

This, of course, does not deny the importance of capital-goods imports for some branches of industry during some periods. For instance, such imports from the Soviet Union played a crucial role in the development of a number of basic industries in the 1950's. Complete-plant imports from Japan, Western Europe, and to some extent the United States are making a major contribution to the expansion of production capacity in the chemical fertilizer, petrochemical, and iron and steel industries, as well as in power generation and commercial aviation, in the 1970's.

Even in these terms China's import dependence must be considered modest in comparison with other underdeveloped countries. China's self-reliance is most pronounced when gaged by the criterion of international financial dependence. As may be seen from Table 7–1, China incurred sizable trade deficits in the 1950's amounting to a total of about $1.2 billion. These were financed by Soviet credits, which were beginning to be repaid in 1955. In 1956 this situation was reversed, and since then and until 1972 China accumulated trade surpluses totaling about $2.3 billion, which were used to repay the Russian aid and finance a Chinese foreign aid program.

Therefore, until recently China was a net exporter of capital, a most unusual situation for an underdeveloped country and particularly for a country experiencing rapid economic growth. As a result, China is one of the very few developing economies free of any long-term debt. However, since 1973, under the impact of a relatively ambitious import program combined with world-recession-induced export difficulties, China incurred large trade deficits, which reached a record of about $1 billion in 1974. These are being financed by a combination of short-term and intermediate-term credits. These balance of payment difficulties may be expected to be of a transitory character. Once world economic recovery gains momentum, the demand for China's traditional exports may be expected to rise. Such increases combined with a gradual growth in oil exports should enable the Chinese to maintain trade surpluses again, which then could be applied to repaying the debts incurred in 1974 and 1975.

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[29] Based on an unpublished paper by R. M. Field, *Real Capital Formation in the People's Republic of China: 1952–1973*, April 1976, Table 19, p. 60.

DISTINCTIVENESS AND TRANSFERABILITY OF THE CHINESE DEVELOPMENT MODEL

China's economic performance must be considered as impressive, based on the overall assessment in the preceding section. There is very little doubt that the Chinese economy has been growing quite rapidly, so that a marked rise in per capita consumption was sustained despite a significant increase in the rate of investment. At the same time, the very wide disparities in income characterizing Chinese society before 1949 have unquestionably been narrowed; precisely to what extent cannot be ascertained on the basis of the available data. Based on partial and tenative evidence, it seems that income inequalities may today be narrower in China than in many—but not all—of the other developing countries and perhaps also in the Soviet Union.

This suggests that after a process of trial and error, Chinese leaders and planners evolved a set of development policies that worked and in essence achieved their principal objectives. This does not mean that no other policies could have been adopted or that the development strategy pursued was necessarily the optimal one. For instance, theoretically, instead of investing so heavily in the intensification of land use in North China where natural conditions are unfavorable and where therefore capital-output ratios are bound to be high, they could have embarked upon an ambitious and far-reaching program of railroad development. Construction of a wide-ranging and reasonably dense transport network would permit much greater inter-regional specialization and economic integration. This would enable China to substitute what may turn out to be relatively cheaper grain imported from overseas, instead of expanding grain production under the rather inhospitable conditions of the North. Under these conditions, resources released in "farmland capital construction," could be devoted to producing farm and industrial products in which China enjoys a comparative advantage.

Such an approach would automatically mean a sacrifice of agricultural self-sufficiency and a much more open foreign trade orientation. It would represent not only a change in strategy but a shift in the Chinese leaders' objectives. It would not only dilute the pursuit of self-reliance but would almost certainly lead to some major changes in rural-urban relations and employment patterns in ways that would run counter to the planners' preferences. At the same time, the leaders could not be assured that this alternative development path would lead to greater stability, higher growth, and better income distribution than the strategy pursued since the early 1960's. In the transition period, while the railroads were being built, China could be exposed to more or less severe balance of payment pressures since food imports would have to be increased before new export commodities were produced with which to pay for these expanded purchases from abroad. This in turn might require foreign loans to bridge this gap, which would also run counter to leaders' objectives.

Even if the policies and measures adopted were reasonably well designed to accomplish the principal leadership objectives, how efficiently were resources utilized in China? On the basis of the highly fragmentary evidence at our disposal, no conclusive judgment is possible. Nevertheless, there is no doubt that the process of resource allocation in China is peppered with numerous instances of inefficiency. This is apparent in the allocation of factory labor, with hoarding of labor and its underutilization in a number of cases. It is also evidenced by the frequent accumulation of large inventories of finished products crated in factory yards but not shipped for considerable periods. It is also illustrated by periodic breakdowns in the production process, particularly in the initial stages of plant operation.

These examples and a number of others one could cite clearly demonstrate that the Chinese economy is not operating at full efficiency. In many instances it may be operating quite inefficiently; but so is every living economic system. The crucial question one would need to address is whether the Chinese economy is operating less efficiently than those of other less developed countries. This question is impossible to answer, not only due to inadequate data but also because of some very complex conceptual problems. All of the instances cited represent cases of static inefficiency. However, in a rapidly growing and changing economy we must consider dynamic efficiency as well. An operation that seems high-cost, inefficient, and technically deficient at one moment in time may become quite efficient over a period of time. Among the crucial variables in this context are learning effects, that is, the capacity to "learn by doing," to learn from mistakes, and the speed at which this can be accomplished. In this respect, however, cultures, societies, and economic systems differ a great deal.

Irrespective of whether China's development strategy is in some sense optimal or whether it is implemented with a high degree of efficiency, the question that needs to be addressed now is in what ways can this strategy be considered as distinctive in comparison with other developing countries on the one hand and socialist economies on the other. As noted earlier, China shares two major objectives with other less developed countries: the quests for increasing power and modernization. This leads all of them to pursue rapid economic growth and technological progress, as the necessary bases for a share of power in the international system and for modernity in the contemporary world. For most of the less developed countries these goals are coupled with a strong striving for a rapidly rising standard of living. This objective is more muted in the Chinese case, at least as an explicit, high-priority one.

On the other hand, the strong commitment to self-reliance and to a socialist and egalitarian pattern of development is a distinctive feature of China's approach to development. Many other developing countries talk of socialism, but only rarely is this translated into concrete operational policies and programs for narrowing inequalities of income. On the basis of partial evidence at least, it seems that in most low-income countries the development process may be associated with growing disparities between regions and between different income groups.

The periodic attacks on status barriers represent perhaps one of the most striking features of the Chinese model. There are no counterparts to the rustication movement in other socialist countries—in the Soviet Union or in Eastern Europe—or in other underdeveloped areas. Nor does one find elsewhere institutionalized measures designed to systematically break down the role differences between mental and manual labor.

In a most fundamental sense, China's development strategy rests on a mass-based mobilization approach evidenced not only in the policies referred to above but also in the distribution of communal services, most notably in the field of health delivery and technology. This is reflected in mass involvement and mass participation not only in the construction of the health delivery system, but also in the diffusion of new technology, in farmland capital construction, in the development of rural industry, and in a wide variety of other measures that are ultimately designed to substitute labor for land and capital.

This whole mass-based development drive seems to be infused with a powerful set of motivations in part based on material aspirations and expectations of a rising standard of living. But these material incentives are combined with strong normative appeals rooted in a vision of a powerful China in which indignities, major inequalities, poverty, human misery, and deprivation will have been eliminated. This combination of material and normative appeals also characterizes the development process in other low-income countries, and in the Soviet Union and Eastern Europe as well. However the weight of patriotic and other ideological appeals as motivators of this drive seems to be much more pronounced in China, at least at this stage of development. Moreover, the whole process is reinforced and lubricated by a continuous push for model emulation and an exhortation to serve the people.

All these features, combined with China's approaches to agricultural development, rural industrialization, methods of industrial planning, and economic administration, do add up to a distinctive development model. Basically this model reflects an interplay between scarcity, ideology, and organization. The harsh realities of poverty and of scarce land, capital, and highly skilled manpower are imposed by China's factor endowments. The objectives of development, stressing a strong, powerful, self-reliant, egalitarian state and society, grow out of China's modern history and contemporary ideology. The systematic massing of labor and its substitution for land and capital is a manifestation of the scarcity of these resources. The methods of mobilizing and motivating labor and all of the human actors in the system is a function of ideology and organization.

To what extent is this model transferable? Are there any lessons to be drawn from the Chinese experience that could be applied in formulating development programs for other low-income countries? The model is the product of a socialist economic system in which the means of production are publicly owned, that is, property is nationalized and collectivized. The economic activities of factory enterprises, communes, and production teams are planned and carried out within a framework of controls. Resources are allocated principally through administrative channels rather than through the market, and prices are for the most part fixed by state authorities.

Moreover, the economic system is permeated from top to bottom with ideology and political organization. Ideology defines values, objectives, models, and attitudes, while organization provides the avenue for indoctrination, education, peer pressure, and more or less subtle forms of coercion (if necessary) through which these are transmitted to and inculcated in the masses. This then becomes manifested in certain patterns of human behavior absolutely critical for the functioning of the economic system and the success of the Chinese development model. These include a highly pronounced work ethic, a capacity for hard work, dedication, self-abnegation, subordination of the self, and willingness to sacrifice for the common good. The Communist Party constitutes a most essential ingredient in this process, both as the source of the ideology and the agent for its dissemination.

In exploring the question of transferability, it is essential to identify the settings in which the Chinese experience might be applicable. In China, the development process is unfolding in a country of unprecedented size; the territorial expanse of the Soviet Union is much larger, while the United States mainland encompasses roughly the same land area as China. However, in terms of population China is in a class by itself, approximated only by India. Size in and of itself carries with it many crucial implications for economic development.

A large country is likely to be endowed with considerable mineral resources and a sizable internal market. Therefore, it is much easier for a large country to pursue a self-reliance policy without sacrificing economies of scale or efficiency. At the same time, a large country necessarily faces much more serious internal transport barriers, which may serve to reinforce the advantages of a regionally based self-reliance policy. These options are not open to a small economy which, given its limited resources and internal markets, must necessarily take advantage of international specialization and international division of labor if it is to develop. Therefore the issue of self-reliance poses itself in a quite different way for a small country. It does not mean reducing its involvement in the international economy, but rather maximizing the degree of national control over the process of resource allocation so that the benefits of development will be distributed to the population at home rather than be transferred abroad. As a result, self-reliance policies as implemented in China are applicable only to a limited number of countries. Other less developed economies may still wish to adopt this posture but its implementation requires a rather different set of policies.

There are also underdeveloped countries that are not as land-short as China. In parts of Africa and Latin America land is a relatively abundant resource. In these cases great reliance can be placed on bringing new lands under the plough, in extending the cultivated land area, and in this way increasing farm production. Since all underdeveloped economies are more or less capital-scarce and such new land programs require vast investments, they may call for a far-reaching substitution of labor for capital. For this reason a major emphasis on "farmland capital construction" may be a necessary feature of development programs in these areas as well, although their form would necessarily differ from that carried out in China.

Therefore, differences in size and resource endowments limit the transferability of China's development model and some of its features to other developing areas. However, there are many more fundamental constraints to this transferability, even to settings in which resource configurations are more akin to those prevailing in China These limits are largely imposed by systemic differences, although cultural factors may also play an important role here. For instance, in the case of India, transferability may be impeded not only by its vastly different economic system but by the lack of linguistic unity, the persistence of the caste system, and a number of other differences in the two traditions.

Leaving aside these very important but quite elusive cultural elements, one of the most crucial questions to be faced is whether the Chinese development model can be transferred to more or less private-enterprise-oriented market economies embedded in a variety of noncommunist political and social systems. As indicated above, the Chinese redistributed income through a series of confiscatory measures which then gradually led to the virtual elimination of private property. To the extent that regional disparities in stages of development and per capita income levels were narrowed, this was achieved through a highly centralized fiscal system with vast resource-allocating powers.

Can inter-personal and inter-regional income inequalities in other developing economies be narrowed without these vast controls over resource allocation and without resorting to these confiscatory measures? Can status barriers between peasants, workers, and intellectuals be attacked on a purely voluntary basis without ideological indoctrination, peer pressure, and a vast organizational effort by a highly disciplined and dedicated political movement? Can the spirit and motivation for hard work, maximum effort, innovation, and self-abnegation be replicated in other developing economies?

There are a number of underdeveloped countries, including Asian countries (e.g., Taiwan, South Korea, Thailand, Malaysia, Indonesia) that have experienced rapid economic growth, marked structural transformation, and a gradual process of modernization since World War II. However, they have accomplished this through development strategies, policies, and instruments markedly different from those applied in China. Except for one or two countries (e.g., Taiwan), in most cases this development was not associated with improvements in the distribution of income. On the contrary, available evidence tends to suggest that growth was coupled with a widening of income inequalities in the lessdeveloped countries.[30]

While it may not be too difficult to design redistributive tax or income-transfer policies for these developing economies, there are enormous political and administrative obstacles to implementing these. Tax morale in these countries tends to be low, the administrative capacity of the government bureaucracies tends to be limited, and last but not least, powerful vested interests can and do bar the implementation of such programs. It is also very doubtful that the kind of spirit, motivation, and social controls prevailing in China can be transferred to the entirely different systemic settings of other developing areas. In essence it is difficult to visualize how particular elements of the Chinese experience can be pulled out of their total context for possible inclusion in the development programs of other countries. The different facets of what may be termed the Chinese development model are quite interdependent and deeply imbedded in the economic, political, and social system as a whole. Therefore it is not at all clear how elements of the model or the model as a whole can be tranferred without adopting the essential features of this system as a whole.

PROSPECTS AND DILEMMAS

The year 1976 may present a particularly uncertain vantage point from which to forecast China's future course of development. With the passing of both Mao and Chou En-lai, it marks a major change in

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[30] See Hollis Chenery, ed., *Redistribution with Growth*, London, 1974, pp. 3–27; Simon Kuznets "Economic Growth and Income Inequality," *American Economic Review*, vol. XLV, No. 11, March 1955, pp. 1–28; Simon Kuznets, "Quantitative Aspects of the Economic Growth of Nations, Distribution of Income by Size," *Economic Development and Cultural Change*, January 1963, part. II.

China's top leadership. Nevertheless, even if the succession were marked by far-reaching political instability, it is improbable that this would lead to a major upheaval and breakup of the country.

However, during this succession period and particularly in a post-Mao-Chou era, power struggles and policy disputes—including economic policy differences—could become seriously aggravated. Therefore, it may be particularly difficult to forecast the future course of China's economic policy. Nevertheless, barring a repetition of Great Leap Forward—or Cultural Revolution-type measures or China's involvement in a major international conflict, the country should be in a position to sustain over the coming decade approximately the same average rate of economic growth as in the past 25 years. This would mean that be the end of this century China's gross domestic product could be quadrupled. In terms of total size it would still lag far behind the United States and the Soviet Union, but could easily be among the five largest economics in the world.

Nevertheless, just as in the past, it will be no easy task to sustain a 6 percent rate of growth. Based on past performance, this will require a rise in farm production of about 2 to 3 percent a year assuming (1) a continued commitment to basic self-sufficiency in food supply, and (2) a rate of population growth of not less than 1.5 to 2 percent a year. This will necessarily pose a major challenge to Chinese agriculture. Over time it will require very large investments in the farm sector and its far-reaching technical transformation. It is far from clear whether such a major transformation can be accomplished within present patterns of economic organization and employment in agriculture. This range of issues will necessarily constitute one of the continuing problems facing the Chinese Communist leadership for the rest of this century and probably beyond.

The successor generation in China will also have to face up to the challenge of sustaining the Revolution, its values and spirit, in the face of rapid economic growth. As industrialization proceeds the processes of production are bound to become more complex. Technical training requirements may also be expected to grow, thus posing a number of dilemmas. Will the educational system as reorganized after the Cultural Revolution be capable of training the advanced engineering, scientific, and technical manpower required for an industrial society? If not, can that system be reshaped in such a way as to continue producing "reds" and "experts"? Can status and income differences be fairly narrowly confined in the face of the growing specialization, division of labor, and functional differentiation associated with industrialization?

Another and closely related range of questions revolves around consumer aspirations. With a fairly rapidly rising product, can household household purchasing power in the cities and in the countryside be kept stable or rise only quite slowly and gradually? Alternatively, will increasing product be gradually translated into increasing consumer appetites? Can consumerism be contained and the spirit of frugality and self-abnegation be preserved?

It is also very unclear whether China can maintain a 10 percent rate of industrial growth for several decades with a preponderantly rural population. This of course will crucially depend on the pattern of industrialization, that is, the technologies used, the scale of plant, and the degree of capital intensity. It may also depend on whether it is possible to design a highly decentralized pattern of industrial development in China that would economize on transport and be partly regionally based. Such a pattern might slow down the rate of urbanization and at the same time alleviate some of the dilemmas posed above.

In essence, the fundamental challenge confronting China's leaders in the coming decades will be to maintain the tempo of economic growth, to build a strong and modernizing China, while preserving socialist values and not only socialist forms of organization. It remains to be seen whether China can become a modern industrial state without perpetuating the "new class" that has been gradually emerging since the 1950's and without following the "revisionist" road. If China's far-reaching experiment were to succeed, it would indeed be a historic contribution to the process of modern economic growth.

SOVIET PERCEPTIONS OF CHINA'S ECONOMIC DEVELOPMENT*

By Leo A. Orleans**

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I. Introduction and Bibliographic Notes

It may seem strange to open with something considered a closing—a biblioigraphic note. In this instance, however, there is a valid reason for such deviation: in order to understand the content and context of this paper, it seems especially important to appreciate the nature of the literature on which it is based. As the title indicates, the purpose of this study is to present the Soviet views and interpretations of China's economic development as expressed in their publications and to let the interested individuals decide for themselves just how valid or delusive Soviet perceptions of China might be. It must be admitted, however, that while 90 percent of the material presented represents Soviet sentiments, the author has found it impossible to keep his own "two cents" out of the analysis. Hopefully, such opinions and comments will be clearly apparent and therefore easily ignored by the reader looking for the unadulterated Soviet viewpoints.

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One learns to read Soviet publications on China just as one learns to read Chinese materials on the Soviet Union. In both countries there is certain prescribed rhetoric and there are standard views that find their way into all the writings. With a little experience one learns what to skip, what to skim, and what to focus on. The problem becomes more difficult when Soviet authors decide to discuss China in terms of Marxist-Leninist polemic. For example, in his *Economic "Theories" of Maoism*, Korbash writes that:

> Development continues to be rooted in objective conditions, while socialist society merely has the opportunity to avoid the waste resulting from uncontrolled development by consciously directing social development in concert with the objective conditions and the economic and social laws of socialism.[1]

One can only hope that the comprehension of such statements, which are quite common in Soviet writings, is not vital to understanding Soviet perceptions of China's economic development.

There is a kind of sameness and dullness about the post-1960 Soviet publications on the People's Republic of China. In part, it is simply their physical similarity: most books are the same size, with dense print, small margins, few subheadings, minimal white space and, of course, no indexes. Anyone who relies on visual memory to help in identifying passages or bits of information for future retrieval, soon finds himself spending inordinate amounts of time shuffling books and leafing through pages in search of something that blends into a forest of words. Much more important, however, is the sameness of content. Soviet Sinologists have to contend not only with a paucity of data (a problem familiar to all China specialists), but also with the ideological and political constraints, which limit their freedom to deviate from the generally accepted opinions and conclusions—at least in open publications available for domestic and foreign consumption. But more about that later.

It is because of the consistency of both themes and economic evaluations that I decided against the standard footnoting procedures. Crediting a specific publication would imply that its author was saying something different or especially perceptive, or that the source has greater stature or authority, while actually the same information or view is available in any number of other sources which are just as official.[1] Instead, I have listed below some of the more comprehensive and more useful publications, while limiting the footnoting essentially to commentary. Although statistics included in the tables are footnoted, in most cases the same or very similar figures could have been cited from other sources. The few differences that may exist between figures in individual sources were not considered to be significant enough to warrant a table of alternate estimates.

Had I completed this project a few months earlier, the commentary would have ended with the preceding paragraph. When I was well into the writing of the report, however, a new Soviet publication came into my possession: A. I. Petrov and L. I. Molodtsova, eds., *Ekonomika KNR: vozmozhnosti i real'nost'* (*The Economy of the PRC: Possibilities*

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[1] A similar evaluation is evident in Rozman's conclusion that "* * * Soviet sinology should be amenable to a general overview which would be inconceivable for the more amorphous American sinology. Centralized control and coordination of training, employment, and publication produces unanimity on essential points, consistency on basic points, and disagreement within well-defined although by no means stationary perimeters." Gilbert Rozman, "Soviet Reinterpretations of Chinese Social History: The search for the origins of Maoism," *Journal of Asian Studies*, November 1974, p. 50.

and Realities) (Moskva: "Nauka" Publishers, 1976), 235 pp. While Petrov is the editor in chief (but not an author) and four of the nine chapters are the work of other contributors, two thirds of the text and virtually all the sections relevant to this report were written by Molodtsova, which explains the use of her name in future references to this work. This book is undoubtedly the most important and the most scholarly Soviet publication dealing with China's economy. It is short on polemic and long on analysis not only of Chinese data but of pertinent Western estimates, which it cites and discusses. Whereas all other Soviet publications take every opportunity to denigrate China's economic performance, Molodtsova revises upwards most of the estimates previously used by Soviet specialists. Curiously, this publication is not the product of the Institute of the Far East, which is considered to be the foremost center of Soviet work on contemporary China; the authors are members of another institute under the Academy of Sciences of the U.S.S.R., the Institute of Economics of World Socialist Systems. Could this explain why the mention of Petrov and Molodtsova to members of the Institute of the Far East produces little more than rather strange and vacant looks? Is it socialist competition, or jealousy, or something more significant? They insist it is only my imagination.

The book raises still other questions about Soviet studies of China's economy. Could the higher estimates of China's economic performance be more representative of the "in-house" figures used by the Soviet Government and not previously available to outsiders? Or is this the first serious product of the greater freedom extended to Soviet Sinologists as a result of a decision to improve and give greater emphasis to the studies of contemporary China? Did the Soviet leadership finally realize that it was not getting the full value from its specialists on China's economy by imposing on them both constraints and conclusions? Are we likely to see a greater diversity in Soviet work in the future? Although, at this time, answers to these specific questions would be mere guesses, in her introduction, Molodtsova does make a few interesting comments about the publication and the upward revision of estimates of China's economic performance. She discusses some of the well-known characteristics of Chinese data, such as their paucity and poor quality, and gives reasons for Chinese secrecy and how it serves the needs of the leadership. Most interesting, however, is that after admitting Peking's tendency to exaggerate, and the penchant to fabricate by local administrative organs, she justifies the upward revisions of China's industrial production by assuming that China's statistical system does not fully incorporate the production of those branches of the economy which are involved in military production. Molodtsova concludes with the statement that the new research, based on all available material from China and all available analyses by Soviet and Western specialists, makes it possible, in the future, to incorporate "corrections into our calculations."

It will be interesting to keep an eye out for the "corrections" in future Soviet publications. But since one book cannot reverse a pattern of decades, the generalizations in this report about Soviet studies of contemporary China, do not take into account the possible changes that Molodtsova's comment (or the book itself) may harbinger.

A. Selected References

There are many Soviet sources which review China's economic development, but in addition to the already highlighted monograph by Petrov and Melodtsova, perhaps the most valuable publication is: M. I. Sladkovskiy, and others (eds.), *Kitayskaya Narodnaya Respublika: politicheskoye i ekonomicheskoye razvitiye v 1973 godu* (Chinese People's Republic: Political and Economic Development in 1973) (Moscow: Nauka, 1975), 439 pages. It is a comprehensive handbook prepared by the Institute of the Far East of the Academy of Sciences of the U.S.S.R. and presumably represents the first annual publication of this type. An English translation of a 1972 Soviet publication entitled: *Present-Day China: Socio-Economic Problems* (Moscow: Progress Publishers, 1975), 248 pages, also contains some useful articles, especially by M. I. Sladkovsky, G. V. Astafyev, G. D. Sukharchuk, and L. A. Volkova. The most important and authoritative journal, which devotes the largest proportion of its space to developments in the People's Republic of China, is *Problemy Dal'nego Vostoka* (Problems of the Far East) and its somewhat abbreviated English counterpart, *Far Eastern Affairs*. This quarterly is the official organ of the Institute of Far East (Academy of Sciences of the U.S.S.R.) and the primary vehicle for the publication of work done by members of the Institute. As such, these publications are indispensable to anyone concerned with Soviet research and thinking on contemporary China. By way of contrast, Russian broadcasts dealing with China (Foreign Broadcast Information Service, U.S.S.R.), whether beamed at China or for domestic consumption, cover many aspects of China's economic development, but are extremely polemic in content and of relatively little value. The few selected sources listed below for specific sections of the report are limited to post-1970 publications.

The basic source used for the section entitled "The Historical Context of Soviet Sinology" is: *Problemy Sovietskogo Kitayevedeniya* (Problems of Soviet Sinology) (Moscow, 1973) which includes the papers delivered at the November 1971 All-Union Conference of Sinologists and which was published in a limited edition (1,000 copies) by the Institute of the Far East. Other sources used in this section worthy of noting are: V. Akimov, "Osnovnyye napravleniya izucheniya ekonomiki KNR i ikh otrazheniye v literature" ("Basic Trends in the Study of China's Economy and its Discussion in Soviet Literature"), *Ekonomicheskiye Nauki*, No. 1, 1975, pages 117–121; "Some Topical Questions in Marxists Sinology," *Far Eastern Affairs*, No. 1, 1976, pages 3–17; V. S. Myasnikov, "Stanovleniye i razvitiye otechestvennogo kitayevedeniya" ("Foundation and Development of Soviet Sinology"), *Problemy Dal'nego Vostoka*, No. 2, 1974.

There is no shortage of materials reviewing the Soviet economic role in China—most of which naturally deal with the 1950's. One of the most comprehensive coverages, however, is in: O. B. Borisov, B. T. Kiloskov, *Sino-Soviet Relations 1945–1973* (Moscow: Progress Publishers, 1975), 366 pages. Also worth mentioning are: O. Ivanov, *Soviet-Chinese Relations Surveyed* (Moscow: Novosti Press, 1975), 56 pages and L. Filatov, "Concerning Soviet-Chinese Scientific and Technical Cooperation," *Far Eastern Affairs*, No. 1, 1976, pages 72–81.

All Soviet writings on China contain information that would be relevant to the section on "Some Recurring Themes in the Critique of China's Economic Policies." Some general sources that focus on this subject are: V. Zhukov, and others, "Sotsial' no-ekonoimicheskaya 'teoriya' i praktika maosima" ("Socio-economic 'Theory' and Practice of Maoism"), *Voprosy Ekonomiki*, No. 7, 1974, pages 99–110; V. Vyatskiy, F. Dimin, *Ekonomicheskiy avantyurizm maoistoy* (Economic Adventurism of Maoists) (Moscow: Ekonomika, 1970), 150 pages; E. Korbash, *The Economic "Theories" of Maoism* (Moscow: Progress Publishers, 1974), 156 pages; V. A. Krivtsov, *Maoism. istoki i sushchnost'* (Maoism: Sources and Substance) (Moscow: Mysl', 1976) 63 pages; E. Konovalov, "Sushschnost' i osnovnyye napravleniya ekonomicheskoy politiki maoistov" ("The Essence and Basic Directions of Maoist Economic Politics"), *Voprosy Ekonomiki*, No. 11, 1974, pages 78–87; Yu N. Ivanov, *Militarizm v ideologii i praktike maoisma* (Militarism in the Ideology and Practice of Maoism) (Moscow: Voenizdat, 1976), 206 pages. A comprehensive critique of China's policies and programs can be found in a series of articles compiled by V. F. Feoktisov in a book called *Maoism Unmasked* (Moscow Progress Publishers, 1972), 146 pages. Of special relevance are the seven artcles in part II of Feoktisov's publication, which is entitled "Anti Marxist Substance of Mao Tse-tung's Socio-Economic Concepts."

Many of the above sources attempt to evaluate the performance of Chinese economy and provide miscellaneous figures to illustrate their conclusions. A few other sources worth mentioning are Z.A. Muromtseva, *Problemy industrializatsii kitayskoy narodnoy respubliki* (Problems of Industrialization of the Chinese People's Republic) (Moscow: Nauka, 1971), 141 pages; M. I. Sladkovdkiy, and others (eds.), *Problemy i protivorechiya industrial'nogo razvitiya KNR* (Problems and Contradictions of the Industrial Development of the PRC) (Moscow: Mysl', 1974), 238 pages; V. Vyatsky, *Economic Policy for Great-Power Aims* (Moscow: Novosti Press, 1973), 95 pages. Anyone interested in biographic data on Soviet sinologists and a listing of their major publicaf tions is referred to an excellent compilation done under the aegis o- the Academy of Sciences of the USSR: S. D. Miliband, *Biobibliografif cheskiy slovar' sovetskikh vostokovedov* (Biobibliographic. Dictionary of Soviet Orientologists), Moscow, 1975, 732 pages.

Finally, a few sources can be suggested to readers who wish to get other opinions about Soviet studies on China or to delve more deeply into subjects other than economics. One of them is E. Stuart Kirby, *Russian Studies of China* (London: The MacMillan Press, 1975) 209 pages. Kirby covers all the topics that make up Soviet sinology, but the book is based almost entirely on the already mentioned Soviet publication, *Problems of Soviet Sinology*. A much more analytical volume, which concentrates on international and political issues is Morris Rothenberg, "*Whither China. The View From the Kremlin*" (Center for Advanced International Studies, University of Miami, 1977), 311 pages. A segment on "The Russian View of Chinese Revolution" is part of a lengthly essay by James Peck in: Victor Nee and James Peck, eds., *China's Uninterrupted Revolution* (New York: Pantheon Books, 1975), pages 175–207. The first two books have fairly extensive bibliographies of Soviet sources on China.

II. THE HISTORICAL CONTEXT OF SOVIET SINOLOGY

There is widespread conviction in the West (and probably in the East, as well) that if there is comprehension anywhere of what is going on in the People's Republic, it is in Moscow. Not only have Russia and China for several centuries shared the longest border between any two nations, but for almost 30 years they have shared a form of government which, at least in theory, only they themselves should be fully able to comprehend. Furthermore, since 1949, the Soviets have been either close friends of the People's Republic of of China—and, therefore, presumably well apprised of the political and economic developments in the country—or bitter enemies, and, therefore, conducting intensive studies on China's strengths, weaknesses, and intentions. Since the general public and even the concerned professional know virtually nothing of Soviet studies on China and are exposed only to the periodic polemic which is released by the news agencies of the two countries and occasionally picked up by foreign publications, the notion of Soviet wisdom and knowledge about past, present, and future developments in China is based more on assumption than on fact. Consequently it is important to take a closer look at that portion of the Soviet establishment charged with the study of China and at its goals and its problems.

A. The Foundation

Russian sinology developed as a result of economic and religious contacts that evolved with China beginning with the second half of the 17th century, when Russian traders ventured across the still-undefined borders between the two countries. Although, of necessity, the traders became adept in the Chinese language, it was in fact the clergy of the Russian Orthodox Church, which had established a diplomatic mission in Peking in 1715, who became the first important sinologists, while the mission itself became a unique center for the study of China and the Chinese language. Quite naturally, much of the emphasis during these early years of contact was placed on Chinese religions, but valuable works on the Chinese language, history, and mode of life were also produced. Toward the latter half of the 19th and the beginning of the 20th centuries, some important Russian explorers and geographers traveled to China and published their observations. In general, however, while some studies on China followed the path of European sinology and focused on the classics, other Russian writings not unnaturally concentrated on events which were of special importance to tsarist political and economic interests and involvements, such as the Taiping Rebellions, the Chinese Eastern Railroad and the Boxer Rebellion. Since the Soviets maintain that early Sinology was strongly motivated by tsarist imperialist aims, official Soviet literature today is predictably critical of the lack of political consciousness in the historical writings, which focused on "philosophical research and the analysis of historical monuments." At the same time, there can be no doubt that their China scholars appreciate the erudition represented in the voluminous literature on China published in the Russian language, nor is there any question that the emphasis on fact and description by early sinologists provided a vital base for the future development of the study of China in the Soviet Union.

Parenthetically, it is both informative and amusing to take a quick look at how the Chinese now view the role of the Russian Orthodox Church in China. According to an article in a Chinese history journal (intemperate in tone but amply footnoted with Russian sources), the history of the Russian Orthodox Church Mission represents a record of crimes against the Chinese people. It is most irritating to the Chinese that Soviet sinologists still do not recognize this and continue to pay homage to the scholarship of "this flock of falcons and jackals." The author maintains that the "church" was "a center of political, economic and cultural aggression against China." The young Russian students sent to study the Han and Manchu languages eventually became "the anti-China backbone force in the Asian Department of the Russian Foreign Ministry." The church mission was involved in "espionage and the stealing of state secrets" and just one of the early 19th century "scholars" departed Peking with 14,000 pounds of books and manuscripts which had to be carried by 15 camels. It was also a member of the church mission, later promoted to representative plenipotentiary, who was responsible for Russia's acquisition of the Chinese territory east of the Ussuri River. Written at the height of the anti-Confucius campaign, the article attacks the Soviets for continued "Confucius worship" and for their respect of early Russian leaders who "wanted to link the dead soul of Confucius with the wild dreams of the Tsar, turning China into the 'Yellow Russia' of the Romanov Dynasty." [2]

Returning to the mundane, in the 1920's and 1930's, a new crop of scholars gave a Marxist twist to the study of Chinese history and society in the Soviet Union. But apparently a twist was not enough, and according to current Soviet interpretation, they too were not objective in evaluating some of the historical events, ignoring evidence of the movements and factors that were emerging at that time.

B. Trends and Cycles Since 1949

The great leap forward in Soviet sinology became evident after the Second World War and especially after the creation of the People's Republic of China in 1949. The volume of publications on China increased dramatically and included not only books and articles by Soviet authors, but also large numbers of translations of important Chinese publications. China specialists exerted great effort to acquaint the Russian people with all aspects of social and economic development in China. Current Soviet evaluation of this scholarship, however, is finally echoing the earlier reactions of Western observers who followed Soviet publications on China through the fifties. The writings were neither analytical nor critical. The authors used Chinese sources almost exclusively quoting Chinese evaluations, figures, and conclusions. Furthermore, according to retrospective Soviet commentary, these publications lent support to Mao's personality cult, they did not evaluate objectively many historical developments, and they kept silent about certain facts which reflected the contradictory forces clearly evident in the revolutionary movement as prescribed by the Chinese Communist Party.

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[2] Fang Hsiu, "Tsarist Russia's Tool of Aggression Against China—the Mission of the Russian Orthodox Church," *Li-shih Yen-chiu* (Historical Research), No. 3, June 20, 1975; translated in *Selections from PRC Magazines*, Nov. 24, 1975.

It is indeed ironic that the Kremlin blames the Soviet sinologists of the 1950's for a lack of "comprehensive evaluation" of the China scene—as if, during those years of close collaboration and cooperation between the U.S.S.R. and the P.R.C., Soviet scholars could have written critical analyses of China and her leadership. It is fascinating, however, that while Sinologists are criticized, they are also provided with appropriate excuses. There is recognition that the emotional element arising from the victory of the Chinese revolution and the Chinese people's successess in building a new life, interfered with objective evaluations of various developments in China by Soviet sinologists. A more interesting excuse given by the Soviets for neglecting the obvious Chinese contradictions is that in the 1950's China did not follow the Maoist line, but essentially followed the more orthodox Leninist theories of socialist revolution. It is further claimed that during that first decade Mao even agreed to some important revisions in his writings, as they were published in the Russion language—thus presumably conceding the error of some of his theories that were most distasteful to the Soviet leaders. Whether or not Mao actually agreed to the revisions made in the Russian translation of his four-volume *Selected Works of Mao Tse-tung*, it is a weak excuse for the lack of critical evaluation. Soviet sinologists and especially their embassy people in Peking must have been well aware of the political factions that were already quite evident in China during that decade. "Politics in command" can undoubtedly be applied to the Soviet side as well.

Yet another reason can be suggested for the absence of analytical content in Soviet writings about contemporary China in 1950's. Most of the Soviet sinologists were associated with the Institute of Oriental Studies (Institut Vostokovendeniya)—an old academic institution which was a descendant of the Asian Museum, founded in St. Petersburg in 1818 and essentially concerned with the history and culture of the peoples of Asia. Even now, only 15 percent of the Institute's staff specialize on China, virtually no one in the China Department is under 40 years of age, and the greatest attention is given to the 1850–1940 period.[3] The increased interest in China after 1949 was reflected in the creation of a separate but short-lived (1956–60) Institute of Chinese Studies (Institut Kitayevedeniya). In part because of a shortage of academics trained in contemporary China studies, it too was staffed mostly by historians from the Institute of Oriental Studies, whose background in political, economic and social analysis relevant to the new China was probably limited.[4] However, the proficiency of these and other Soviet sinologists in Chinese language and history did enable them to use available Chinese materials and produce large numbers of publications describing developments in the People's Republic of China as presented by the Chinese themselves; publications, incidentially, that are very useful to anyone interested in the first decade of the People's Republic. Actually, the Russian scholars were very fortunate that relations between the U.S.S.R. and China in the 1950's did not require them to conduct intensive and critical analyses and interpretations of the Chinese scene—a very difficult and delicate task for an academician who has spent his professional lifetime studying the genesis of Chinese civilization or ancient Chinese poetry.

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[3] Unpublished paper by Gilbert Rozman, entitled "Report on a One-month Visit to Assess Soviet Sinology, Dec. 19, 1977–Jan. 19, 1978." Some of the other comments in this section are also based on Rozman's observations. During an earlier visit by an American correspondent, some of the top sinologists at the institute agreed to discuss modern China, but wanted it clearly understood that the competence of the institute ends with the 13th century. (Dan Morgan, "Soviets Encounter Difficulties in Reading China Tea Leaves," *The Washington Post*, Aug. 27, 1972.)

[4] The Soviets themselves now admit that Stalin purges of the 1930's resulted in a serious depletion of China scholars in the Soviet Union.

The 1960 split between China and the U.S.S.R. resulted in a drastic decrease in Soviet publication about the P.R.C. The Institute of China Studies was abolished and apparently its staff returned to the Institute of Oriental Studies. (The latter was renamed the Institute of the Peoples of Asia—a name that held until 1971, when it reverted to the Institute of Oriental Studies.) Most of what was published by the Russians during the first half of the sixties attacked Mao and the Maoist leadership for the misuse and perversion of Marxist-Leninist theories and doctrines in general, as well as for his "adventurist economic policies" and the debilitating effects of the "Great Leap Forward." Although some of the sinologists lent their expertise to buttress the content of the polemic, most Soviet publications during this period were not published by the Academy of Sciences or its institutes, but mostly by such organizations as the Institute of Marxist-Leninism and the Higher Party School, both under the Central Committee of the Soviet Communist Party. It must be said, however, that in reading these attacks (as blatant as any published by the Chinese) one also senses a considerable degree of disappointment and frustration about the turn of events and the failure of Soviet attempts (especially in 1963 and 1964) to improve relations. Moscow seems to have been sincere in its belief that "despite serious ideological differences (between Peking and Moscow), it was nevertheless necessary to strive for unity in practical activities, above all in the struggle against imperialism."

The initiation of the Great Proletarian Cultural Revolution in 1966 and the border incidents in 1969 finally convinced Moscow that efforts to patch up the differences with Peking were not likely to produce any immediate results. China was obiously departing even further from what the Soviet leaders considered to be rational policies and there was no longer any doubting the necessity for really serious analysis and evaluation of developments in China and her capabilities as a military and political competitor. This point was stressed by Leonid Brezhnev at the 1969 international meeting of Communist and workers parties:

> It is a big and serious task to make an allround Marxist-Leninist analysis of the class content of the events in China over the last years, and of the roots of the present line of the CCP leaders, who have jeopardized the socialist gains of the Chinese people.

For serious research on contemporary China, the Soviets turned to the recently created (1966) Institute of the Far East (Institut Dal'nego Vostoka). This institute, under the Academy of Sciences of the U.S.S.R. is charged not only with the coordination of all Soviet research on China's economy, foreign affairs, politics, ideology, and other current problems, but is undoubtedly also responsible for supporting various government agencies with information and reseach on the P.R.C. In addition to its research functions, the Institute of the Far East is active in publishing and in holding conferences on various aspects of contemporary Chinese studies. The large staff of its China department is apparently still growing and is probably drawing off some of the younger China scholars from the Institute of Oriental Studies, where most of the work continues to focus on history and the humanities.

From Soviet publications it is very clear that in the 1970's serious research on contemporary China is also being conducted at some of the other institutes under the Academy, such as the Institute of the International Workers' Movement (Institut Mezhdunarodnogo Rabochego Dvizheniya) and the Institute of the Economies of World Socialist Systems (Institut Ekonomiki Mirovoy Sotsialisticheskoy Sistemy), as well as in some of the country's universities with centers for Chinese studies, such as the Leningrad State University, the University of Tashkent, the Far Eastern State University in Vladivostok. The Moscow State Institute of International Relations. The University of Moscow's Institute of Oriental Languages as well as other academic institutions have increased the production of Chinese linguists, many of whom spend time in Singapore for advanced language training. The Chinese language has even been added to the curriculum at two of Moscow's middle schools (No. 11 and No. 14). Thus, with this new priority and with the availability of a growing number of younger China specialists—many of whom experienced living and working in China during the previous 20 years—the Soviets initiated a more academic and a more intensive approach to the study of contemporary China and started to publish more substantive works by serious scholars.

An event of special importance in the strengthening of Chinese studies in the Soviet Union was the first national conference of sinologists, which was sponsored by the Soviet Academy of Sciences and which took place at the end of November 1971 in Moscow. In his introductory remarks to this 3-day meeting, P. N. Fedoseyev, a philosopher and vice president of the Academy, announced to the assembled scholars that the central committee of the Soviet Communist Party and the Soviet Government consider research on the People's Republic of China to have special priority, both in terms of politics and scholarship. Russian sinologists, from Leningrad to Vladivostok, were told that China would inevitably play a leading role in world affairs and urged them to expand and intensify their studies of contemporary China. Furthermore, Fedoseyev noted that the shortage of China specialists in the Soviet Union at that time demanded particularly close coordination in the work of academicians and pedagogues in various educational institutions. And finally:

> The efforts of our scholars-sinologues have to provide practical assistance to our party and our government agencies in working out specific policies in our relations with China, and to promote the restoration of friendly relations with the Chinese people.

How to promote "friendly relations with the Chinese people," while engaging in highly inflamatory rhetoric has not yet been solved by the Soviets, so that the adversary relationship continues to be all too evident even in scholarly publications.

C. Economic Studies

The trends in Soviet studies of China's economy followed those of Chinese studies in general: Basic compilation of developments as described in Chinese sources during the 1950's; a drastic decrease in publications (but perhaps not research) between the early and late 1960's; and finally a resumption and a gradual intensification of research and publications from the late 1960's to the present time. In economic studies as in other fields, the Soviets now readily admit that "the publications of the 1950's all too often painted a much too rosy picture of China's economic development, omitting the difficulties of development and the miscalculations which were permitted in the management of China's economy." [5] The Soviet evaluation of China's economic sectors will be reviewed in the next section; here we will present an evaluation of Soviet economic studies of China, for the most part as presented in a very frank report by G. B. Astaf'yev at the 1971 conference of sinologists. It is important for the reader to keep the date of that conference in mind.

According to Astaf'yev, economic study of China has been among the most backward sectors of sinology in the Soviet Union. Because of the small number of economists specializing in Chinese studies, the largest proportion of Soviet works was devoted to the general characteristics of economy and to the problems of political and historical economics. Questions relating to regional economics, specific economic sectors, labor productivity, specialized manpower, the role of education in the industrial process—questions which are vital to the evaluation of China's economy—have received little attention.

The weakness of economic analysis in the Soviet Union is also laid to the lack of statistical data since 1959—a complaint familiar to analysts of China's economy around the world. What is curious, however, is the Soviet complaint about the Chinese use of relative figures (percentages) for which no base figures are available. Anyone who has had any experience with earlier Soviet economic statistics must remember how prevalent and frustrating was their own use of percentages that did not relate to any available absolute figures.

In any case, in the late 1960's, when the study of China's economy was assigned special priority and activated the training of young economists with a China specialization, the level of research at academy institutes and educational institutions started to improve. Work on China's economy is now taking place not only in the China Department of the Institute of the Far East but also in departments specializing in agriculture, industry and transport, general socioeconomic problems, public welfare and demographic problems. Other Academy institutes doing research on China's economy are, for example, the Institute of World Socialist Economic Systems, the Institute of the International Workers' Movement and the Scientific Research Institute of Business Cycles, under the Ministry of Foreign Trade. In addition to Moscow, China's economic problems are also being studied in Leningrad and Khabarovsk and by the faculties and department of a number of major universities.

Among the priority problems the Soviets list for their economists to work on are the differences between the socialist and Maoist political superstructure, the characteristics of the development of productive forces, the main features of China's industrialization, the prospects of economic development in relation to demographic pressures and continued military buildup, the backwardness of agriculture, and the low level of people's well-being. Since it is very likely that Chinese economic data will continue to be very scarce, Soviet economists are told that their task in developing methodologies and economic indicators will not be an easy one and they are urged to use mathematical methods and computer technology. They are also to use logic in analyzing social and economic phenomena since 1957 and to make better use of individuals from Soviet industries. The absence of imagination and innovation in the Soviet approach to China studies has been very obvious to Western specialists and it is interesting to note their own belated awareness that textbook methodologies tend to be of limited value in the analysis of China's economy.

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[5] V. Akimov, "Basic Trends in the Study of China's Economy," *Ekonomicheskiye Nauki*, No. 1, 1975.

III. BRIEF REVIEW OF SOVIET ECONOMIC ROLE

The volume of economic and technological assistance that crossed from the Soviet Union to the People's Republic of China between 1949 and 1959 is unmatched in history. But while in the 1950's Soviet publications tended to exhibit a degree of reticence (modesty?) about their role in China's recovery and rapid economic development, since 1960—and especially since the Cultural Revolution—they have shown no restraint in detailing the nature and chronology of their aid. The tendency to detail Soviet aid is not limited to writings on China's economy; the unselfishness of the Soviet Union in providing assistance manages to get into almost all texts on China, no matter what the basic theme of the publication. With Moscow's changing attitudes and modes, the same facts and figures relating to Soviet aid have been placed within contexts reflecting bluster and arrogance, hurt feelings, dejection and disappointment; the example of the 1950's has frequently been dangled to lure the Chinese back to the fold. There are also the inevitable quotations by Chinese leaders expressing their gratitude and promising "never to forget the fraternal assistance rendered by the Soviet people." The favorite quotations are naturally by Mao Tse-tung and Chou En-lai in which they praise the Soviet Union for "inspiration," "indestructible friendship" and "selfless assistance." By now we know, incidentally, that the sincerity of these and similar statements eminating from Peking was spurious. The leadership may have been grateful for Soviet willingness to help, but they were highly resentful of the toughness of the negotiations that preceeded every agreement and the financial and political cost of Soviet assistance. China received few presents; she paid for most of what she got.

The following summary of the nature and substance of Soviet-Chinese economic relations is derived entirely from Soviet sources and expresses Soviet perceptions—whether explicitly stated or not. The reader is also cautioned that this particular perspective may leave the mistaken impression that Sino-Soviet differences stemmed almost exclusively from contraversies over economic approaches to China's development. These issues were very important, but primarily to the extent that they reflect the more basic and vital ideological, political and strategic differences.[6]

A. The First Years

In 1950, less than 5 years after the Soviet Union drastically reduced Manchuria's industrial capacity[7] by dismantling and carrying off most of the more modern equipment from that region's industrial installations, a series of agreements were signed between the new Communist regime in China and the U.S.S.R. which laid the foundation for Sino-Soviet economic cooperation. An agreement signed in February 1950 committed the Soviet Union to return to China, without any compensation, all the properties and buildings appropriated by the Russians in Manchuria after the defeat of Japan and to help China rehabilitate, reconstruct, and build anew 50 enterprises. In some instances, therefore, this involved not only the delivery of whole plants, but also assistance in research and design work, in developing the production of new types industrial goods, and in assembling and adjusting the equipment. The equipment and materials involved in this agreement were later calculated to be worth $300 million[8] and the Soviets quote Chinese sources which stated that this was at least 20 percent cheaper than any comparable purchase from capitalist countries. The repayment was to be made at an annual interest rate of only 1 percent and was to be made in the form of Chinese raw materials to be delivered to the Soviet Union in equal parts over a period of 10 years. Parenthetically, however, it should be pointed out that this assistance represents but a fraction of the support Mao asked for.

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[6] For an excellent discussion of the numerous issues responsible for the Sino-Soviet schism, see: A. Doak Barnett, *China and the Major Powers in East Asia* (Washington: The Brookings Institutions, 1977), pp. 20–87.

[7] Alexander Eckstein, *China's Economic Revolution* (London: Cambridge University Press, 1977), p. 26.

Under the 1950 Treaty of Friendship, Alliance and Mutual Assistance, the Soviet government also pledged to restore and handover to China, free of charge, and before the end of 1952, all its rights to the Changchun Railway and all its property; a commitment they honored. The two Governments agreed on Soviet troop withdrawal from Port Arthur and Dairen and on relinquishing to the Chinese all the facilities, including the naval base, at this strategic location. Three Sino-Soviet joint-stock companies were established: Sovsinmetal—to prospect for, extract and process nonferrous and rare metals in Sinkiang Province; Sovsinoil—to prospect for and extract oil and gas; and the SKOGA company to operate China's air services. Both sides were to share equally in the capital and management of the companies, but in 1954 all three companies were turned over to the Chinese.

A trade agreement signed in Moscow in April 1950 was to provide China with gasoline, paraffin and lubricants, machines and tools, transportation equipment, cotton, raw materials, fuel and other materials that were indispensable for China's economic rehabilitation. By 1952, the Soviet Union accounted for more than 53 percent of China's overall foreign trade turnover. Numerous other agreements signed in 1950–51 ranged from postal, telegraph, and telephone communication to the navigation of rivers bordering the two countries. During these early years, the Soviet Union claims to have supplied China with 943,000 tons of ferrous metals (equivalent to about 40 percent of China's total output) and 1.5 million tons of petroleum products, including over 500,000 tons of gasoline and 477,000 tons of kerosene.

Although in 1952 there were nearly 1,000 Soviet specialists in China, the U.S.S.R. never sought to use its specialists to gain any kind of control over the Chinese economy. While Soviet specialists participated in design work and construction, assembly and commissioning of enterprises, they also were involved in training large numbers of Chinese personnel. Furthermore, large groups of engineers and technicians, as well as tens of thousands of Chinese workers, came to the U.S.S.R. for training during those years.

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[8] This report uses dollars, rubles and yuan, as cited in Soviet sources. No effort has been made to convert figures into a single currency.

Even though the Soviets may overstate their claim, it is difficult to quarrel with the importance of their support and experience (and "the aid of the Soviet people") in enabling China to overcome her economic difficulties and in laying the groundwork for a successful transition to planned Socialist construction.

B. The First Five-Year Plan (1953–57)

China's First Five-Year Plan was drawn up with the most active assistance of Soviet specialist and was "oriented to all-round Soviet material, scientific, and technological assistance." Throughout the 5-year period China and the Soviet Union continued to sign agreements detailing the nature and scope of the intensified Soviet aid. One of the more important of these agreements was signed in May 1953, committing the Soviet Union to the construction or modernization of 91 large industrial projects—in addition to the 50 agreed to in 1950. Although there are some discrepancies in Soviet literature as to the exact number of enterprises that were actually built, the differences are not very significant, especially since the orignial target figure was exceeded. During the First Five-Year Plan, the U.S.S.R. helped to start the construction of 156 enterprises, among these 12 coal, 29 electric power, 17 metallurgical, 8 petrochemical, 26 metalworking, 1 papermaking, 1 textile, and 1 food processing.

Some of the other agreements signed during the period of the First Five-Year Plan gave China long-term credit of 520 million rubles, provided for assistance in the construction of the Chi-ning-Ulan Bator and the Lanchou-Urumchi-Almi Ata rail lines (for strategic and other reasons the Chinese never saw fit to complete the Urumchi-Alma Ata leg), assured China of close scientific and technological cooperation, and resulted in a significant increase in the volume of Sino-Soviet trade. In addition to the more formal assistance provided by the U.S.S.R., Moscow was also prone to giving China annual anniversary gifts. For example, on the fifth anniversary of the creation of the PRC, the Soviet Union gave China a present of equipment and machinery for a graingrowing state farm, which included 98 tractors, 100 harvesting combines, and 39 trucks and cars.

Although at the time they were difficult to spot, it is now clear that the first signs of tension between the U.S.S.R. and the P.R.C. surfaced in 1956 and 1957. According to Soviet specialists, while Chinese sources were enthusiastically supporting "the correct policies of the Soviet Union," Mao's "special conceptions" about the direction of Chinese development were already being hatched. And while officially the Chinese supported the Communist Party of the Soviet Union for displaying "great determination and boldness in doing away with the cult of Stalin and in exposing the gravity of Stalin's mistakes"—a quotation from the *People's Daily,* cited by Moscow—Mao was building up his own cult of personality. Soviet sources are prone to long discussion about China's political infidelity during this period and her doubletalk about Stalin, Hungary, and about China's ulterior motives aimed at provoking a military conflict between the Soviet Union and the United States. But let us not digress—back to economics.

Despite these harbingers of thing to come, the Soviet Union continued to help the Chinese people—with an emphasis on people—in building socialism. As a matter of fact, in 1956–57 Soviet assistance to China increased. Among the numerous agreements and protocols that were signed, perhaps the most significant (April 1956) called for Soviet assistance in developing several industries and provided for the construction of 55 industrial projects in addition to the 156 projects that were being built under earlier agreements. These 55 projects included metallurgical, engineering, and chemical plants, synthetic fibers and plastics factories, electrical and radio engineering enterprises, a synthetics liquid fuel plant, and electric power stations, as well as research institutions for the aircraft industry. The total cost of equipment, design operations, and other technical aid was to reach 2,500 million rubles.

If the Soviets were to pick the one assistance agreement they regret the most, no doubt it would be the 1955 agreement to help China build her first experimental atomic pile and cyclotron. At that time, the Soviets referred to it as "a splendid expression of the Soviet Union's foreign policy of peace" and as "a new contribution to the great friendship between the two countries." But it was this assistance and the subsequent training of some of China's nuclear scientists at Dubna that launched China as a nuclear power. In 1956–57, the Soviet Union also continued to give China military aid to strenghten that country's defense capabilities. Not only were the Chinese armed with Soviet military equipment, but thousands of Soviet military advisers "shared their experiences with the Chinese People's Liberation Army."

Important cooperation continued in the field of science and technology. Joint exploration and research agreements were signed to identify China's natural resources and to study the prospects for developing the productive forces in a number of China's border areas, most significantly in the Amur River basin. In 1956, the Soviet Union sent a large group of scientists to China to help draw up the extensive 12-year plan on science and technology, which was to be closely coordinated with economic planning and was to insure that scientific development would serve the needs of the state. A 1957 meeting of the Sino-Soviet Commission of Scientific and Technical Cooperation decided to further encourage direct contacts between related Government departments, ministries, and research and design centers, in order to focus on the key scientific and technical, problems facing China's industry and agriculture. That same year an agreement was signed for scientific cooperation between the two academies of sciences, providing for joint research and expeditions and coordination of work on the key problems of science and technology. It was during these last 2 years of the 5-year plan when, according to the Soviets, their assistance was at its peak, that China made her greatest breakthroughs in economic and scientific development. Once again, the Soviet claim is essentially valid.

C. 1958–59

Using buzz phrases that have special meaning to the Russians, the Soviet Union blames voluntaristic methods of leadership, the cult of the individual alien to Marxism-Leninism, and China's petty bourgeois nationalistic policies for Peking's parasitic attitude toward the U.S.S.R. and for its denigration of Soviet experience and prestige—attitudes that began to be evident in 1958 and that have continued since then. As in the past, however, the Soviet Union is proud of remaining loyal to its internationalist responsibilities and of continuing to give China assistance in the development of her economy, science, technology, and culture.

In August 1958, for example, an agreement was signed in Moscow for Soviet technical aid in the building and expansion of 47 industrial enterprises and power stations. And even in 1959, when despite growing tensions, the Chinese still came out with occasional assurances of loyalty to Sino-Soviet friendship, an agreement was signed for Soviet assistance in building 78 big projects in the steel, chemical, coal, oil, engineering, and building materials industries, as well as in the construction of power stations. By this time, the total value of Soviet equipment deliveries, design work, and other technical assistance neared 5,000 million rubles. As in the past, this aid was to be repaid with Chinese exports under the terms of the operating Sino-Soviet trade agreement, but licenses to manufacture products, blueprints, and other technical documents were handed over to China free of any charges.

Cooperation also continued in the scientific and technical fields. In January 1958, a Chinese delegation headed by then president of the Chinese Academy of Sciences Kuo Mo-jo, completed a 3-month visit to the Soviet Union. The delegation held discussions with over 600 leading Soviet scientists and experts and left with yet another signed agreement for Soviet aid in scientific and technological research and training and in the supply of equipment, instruments, and materials which the Chinese felt they needed for the execution of their Twelve-Year Plan on Science and Technology. The agreement also provided for joint research on 122 key scientific and technological problems of fundamental importance to China, that was to run through 1962.

In summarizing their aid to China between 1949 and 1959, the Soviets claim that of China's total production in 1960, the share of products manufactured at enterprises built with Soviet technical assistance was as follows: cast iron, 30 percent; steel, about 40 percent; rolling stock, over 50 percent; trucks, 80 percent; tractors, over 90 percent; synthetic ammonia, 30 percent; electricity, 25 percent; steam and hydraulic turbines, 55 percent; generators, about 20 percent; aluminum, 25 percent; heavy machine-building industry products, over 10 percent. It was Soviet assistance in the 1950's that formed the backbone of modern industry and secured future possibilities for implementing the entire program of industrialization in China. A similar impact of Soviet aid is claimed in science and technology and in the training of specialized manpower and education in general.

D. The Break

While Soviet specialists working in China began to experience sharply worsening relations with Chinese personnel by the latter half of 1958, the Soviet government seemed to close its eyes to some of these problems. They apparently hoped that the Great Leap was a temporary aberration and that the Chinese leadership would soon come to its senses. Furthermore, their relative tolerance during that period was sustained by some contradictory vibrations that emanated from Peking—contradictions that are not at all uncharacteristic of Chinese policies during the past two decades. While slogans urged workers to fight "blind faith in foreign experience," which at the time were directed specifically against the Soviet Union, Chou En-lai and other top leaders continued to praise the Soviet Union for "the brilliant example of Socialist and Communist construction" and to express "profound gratitude to the government and the people of the Soviet Union" for their "all-round assistance in socialist construction." Some of these comments were made as late as October 1959 at the 10th anniversary of the P.R.C.

The situation became intolerable in 1960. Soviet specialists began to be regarded with even greater suspicion, were subjected to surveillance, their personal belongings were searched, and their letters were censored. All Soviet protests about the treatment of their citizens fell on deaf ears. According to the Soviets, the Chinese not only began to curtail cooperation in all fields, but guided by political considerations, they abstained from the official commissioning of many enterprises built with Soviet assistance. By August 1960, the harassment of Soviet specialists, increasing obstacles in the operation of the Soviet Embassy, and other provocative actions of the Maoist leadership forced the Soviet Union to recall the 1,600 specialists who were still in China at that time. The result was an inevitable and rapid decline in economic, scientific, technical, and cultural cooperation between the U.S.S.R. and the P.R.C. Thus, the Soviets reject outright all Chinese accusations that the withdrawal was initiated by the U.S.S.R., thereby causing the failure of the country's economy. It was China who created the conditions that forced the withdrawal of the specialists, and in any case, because of the conditions that prevailed following the Great Leap, Chinese industry failed to fulfill its plan even before the specialists were withdrawn.

But even at the nadir of relations between the two countries, a constant theme was heard in all Soviet sources: out of concern for the Chinese people, and with varying degrees of success, the U.S.S.R. continued to extend assistance—while the Chinese continued to hinder and frustrate such efforts. In view of her food shortages, the Kremlin, on its own initiative, relieved China of her arrears in 1961 for food deliveries in 1960 and "abstained" from purchasing almost all of the foodstuffs which had been traditional items of Chinese export. The Soviet Union also gave China great assistance by lending her 300,000 tons of grain and flour and, to help with the shortage in foreign exchange, agreed to buy from China 1,000 tons of silver to be paid for in hard currency.

As for assistance in industrial development, even after China's "demand" for a sharp reduction in the implementation of earlier agreements and protocols for economic, scientific and technical cooperation and her rejection of further Soviet assistance in the construction of 1,100 million rubles worth of industrial and other projects, the Soviet Union intended to keep its commitments to provide technical assistance in building 66 projects of key importance for the development of both the civilian and defense industries. By mid 1961, the Chinese authorities no longer blamed the Soviets for China's economic problems (they resumed such accusations just a year or two later), but explained the drastic reduction in deliveries of Soviet equipment and in the volume of trade, by pointing to natural disasters in agriculture and stressing the need to be more self-sufficient. No doubt this very temporary lull in rhetoric facilitated the signing of an agreement in June 1961 for technical assistance in building some new projects and even raised the hope of the return of Soviet engineers and technicians to China. This relaxation was short-lived, however, because just 6 months later the Chinese announced their absolute refusal to import Soviet complete plants and equipment and "arrogantly declared" that the P.R.C. was no longer in need of developing scientific and technical exchanges with the Soviet Union.

E. 1962 to the Present

By the end of 1962 the volume of economic cooperation between the Soviet Union and China had dwindled to about 5 percent of the 1959 volume. Supplies to China of Soviet equipment, materials, technical facilities and documents dropped to 41 to 42 million rubles as against 428 million in 1960. Supplies of complete plant and equipment amounted to 7.8 to 8.0 million rubles as compared with 336.5 million in 1959. But even as the situation between the two countries continued to deteriorate and attacks against the Soviet Union for damage to the Chinese economy accelerated, Moscow proudly proclaims that the U.S.S.R. continued to abide by its commitments and in 1964 supplied equipment and materials for 31 industrial projects under the agreements then extant.

Soviet sources tend to go into some detail about the fraudulent methods used by the Maoists to discredit Moscow's assistance, such as disassembling Soviet machine tools and then assuring foreign visitors the equipment was delivered in an unfit condition, and displaying broken down locomotives which the Chinese implied were delivered without spare parts. One interesting tale pertains to Sino-Soviet trade talks which took place in 1964—the year trade between the two countries dropped back to the 1950 level. As the Soviets tell the story, they wanted to continue to import tin, zinc, beryllium and other commodities which had been traditional items of Chinese export to the U.S.S.R. The Chinese, however, "pressured and blackmailed" the Soviets to import foodstuffs from China, including items that China found difficult to sell on the world market. The Chinese then spread the fabrication that the Soviet Union was importing "hundreds of thousands of tons of meat products" from China, whereas the actual Soviet meat imports in 1964 totaled little more than 40,000 tons. It is not altogether clear whether the Soviet sensitivity to China's accusations stems from the implied meat shortage in the Soviet Union or from the implied deprivation suffered by the Chinese people as a consequence of these exports.

It would appear that in 1965–66, with the exception of some very limited trade activity, there were no economic relations between the two countries. In April 1965, the P.R.C. finally cancelled all work on projects agreed to in June 1961 and Soviet supplies of completed plants and equipment to China diminished to less than one-hundredth of the 1959 level. Furthermore, the Chinese deliberately played down the political importance of trade by proposing that in the future it should be developed not on an intergovernmental but on a ministerial basis. In 1966, as China's trade decreased with the Soviet Union to less than 300 million rubles, it increased with the non-Soviet bloc countries to 75 percent of the total trade turnover.

Although the Soviets also blame the Chinese for a total lack of cooperation in science and technology as well, both sides still made a showing at the 15th session of the Sino-Soviet commission on scientific and technical cooperation in November 1966. It is not surprising however, that there was little cooperation at the conference and contracts between the academies of sciences of the two countries reached a new low.

As viewed from Moscow, the major distinctive feature of the Cultural Revolution was its "clear-cut anti-Soviet orientation." Indeed, to read through Soviet lists and statistics of Chinese attacks and accusations one is likely to forget the internal struggles, the purges, the strikes and the Red Guards, and accept the Soviet contention that "anti-Sovietism" was the main objective of the masterminds of the Cultural Revolution.

In the 1967–69 period, the Chinese closed all channels of economic cooperation and the 86 million rubles worth of trade in 1968 was carried on the basis of contracts for individual commodity items. China also withdrew from agreements dealing with cooperation in saving lives and rescuing ships and aircraft in distress at sea, continued their "splitting activities" in railway, electrical and postal agreements of cooperation, and forbade transit across Chinese territory of cargoes of foodstuffs and medicines for Soviet specialists in Vietnam. Soviet proposals to reactivate economic ties and expand trade were repeatedly ignored so that by 1969 trade between the U.S.S.R. and the P.R.C. diminished to 51 million rubles and then to its lowest level in 1970, before, thanks to Soviet persistence, the trend was finally reversed with the signing, in November 1970 of the first of a series of new trade agreements. By 1976 China's trade with the Soviet Union was back to 314 million rubles, before declining in 1977 due to China's cancellation of Soviet made generating equipment and civil aircraft. In general, however, the Soviets are optimistic that in the future Sino-Soviet trade will develop on the basis of "equality and mutual advantage."

In reviewing their aid to China, the Soviets conclude that it is the assistance they provided in the 1950's which made it possible for China to experience early successes and which also turned the head of Mao and his entourage, fanned their great-power hegemonistic aspirations and served as fertile ground for nationalistic tendencies in the Chinese leadership.

IV. SOME RECURRING THEMES IN THE CRITIQUE OF ECONOMIC POLICIES

At a recent seminar on Sino-Soviet relations, a speaker from the Soviet Embassy in Washington was asked if there was anything positive he could say about Mao Tse-tung's role in making China what it is today. He allowed (rather reluctantly) that perhaps Mao did make a contribution as a unifier of China's revolutionary forces, but after some hemming and hawing this diplomat could not come up with anything positive to say about China's leader. When asked, in a followup question, whether he thought that China would have been better off without Mao, the speaker was obviously uneasy and was unable to say either "yes" or "no" to the question. This, of course, is not surprising, for unlike China's shrill and broad-based onslaught against the Soviet Union, Moscow's attack has been essentially focused on Mao and his followers. Mao was the culprit and it was his supporters and his thoughts which drew China away from socialism and substituted what the Soviets consider to be an eccentric and even a bizarre system of government. But while accusations against Mao range far and wide (anti-Marxist, antihumanist, adventurist, and so forth), his role in formulating economic policy draws some of the bitterest attacks from virtually all Soviet writers.[9] And incidentally, they almost never use the term "Chinese," which might be misconstrued as referring to the people; the terms they use are "Maoist" and "Maoism," which refer to the leadership and the philosophy. Under present conditions, say the Soviets, "anti-Maoism is a consistent expression of friendship for the Chinese people."

One of the gentler words with which the Soviets characterize China's post-1957 development is "unusual." While it departed from socialism, it did not move toward capitalism; instead, Mao's petty-bourgeois approach toward all difficult economic problems led China into an artificial system of socioeconomic relationships. The abrupt shift from a scientifically grounded and balanced economic development to Mao's "untenable subjective schemes" also made it necessary for China to find a rationale for Mao's policies and to create new economic theories. This was done through the "vulgarization" and revision of Marxism-Leninism. In this regard, the Russians are fond of citing some of the quotations from Chinese publications, such as the following from a 1967 issue of the *People's Daily*: "Marxism has now reached an entirely new stage. In the early 20th century it reached the stage of Leninism, whereas in the present epoch it has reached the stage of Mao Tse-tung thought." Soviet distaste for such a statement is not difficult to understand.

The Soviets reject outright any suggestion that since the smashing of "the gang of four," China has been undergoing a process of de-Maoization under a more pragmatic leadership. There has been no retreat from the theory and practice of Maoism, they say. While "the gang of four" has served as a "safety valve to vent some of the accumulated dissatisfaction in Chinese society," the "new" policies are nothing more than "the adaptation of Maoism to altered conditions"; Maoism is being "tidied up" in order to strengthen it.

A. Mao—"The Economist"

Mao never had any training in economics, according to the Soviets, and his mental horizon was circumscribed by the conservative way of life of the peasant family with its constant poverty and illusory dreams of a better but vaguely envisioned future. Neither Mao, nor any of his followers ever systematically set down their views on how the economy should function. His ideas evolved gradually—for the most part "during the latest period of Mao Tse-tung's practical and theoretical activity," whatever that specific period might be. In analyzing Mao's speeches and reports, the Russians come to the conclusion that even after assuming leadership of the country in 1949, he still had no definite economic program for the development of China. His one basic goal was to "average out poverty," and his basic thesis boiled down to this: when there is hunger, the urge toward equality becomes as powerful as religious fervour.

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[9] For a more balanced view of Mao's economic thoughts, the reader might want to consult Christopher Howe and Kenneth R. Walker, "The Economist," *Mao Tse-tung in the Scales of History*, ed. Dick Wilson (Cambridge: Cambridge University Press, 1977), pp. 174–222.

Since Mao never systematized his economic concepts, they can only be surmised through the analysis of his proclamations and by observing how the various policies are implemented. The difficult task for Soviet economists, then, is to extract the essence of the programs from the "demagogic ultrarevolutionary phraseology," rampant in the pretentious presentation of general laws of development in order to camouflage the true content of China's economic policies.

The Soviets maintain that because Mao did not understand economic theory, his preoccupation with "politics in command" caused him to overestimate subjective factors. The notion that ideas become a material force when they take hold of the masses is taken out of context by the Maoists, because only objective socioeconomic requirements can advance social development. Lenin fully understood the importance of politics, but he also wrote that after Soviet power is established, "political tasks occupy a subordinate position to economic tasks." In other words Maoists pervert Lenin's thesis in that politics is ultimately determined by economics and not the other way around, as the Chinese would have it. Mao's belief in the "uninterrupted revolution" and his policy of initiating endless political movement is referred to as "the kaleidoscopic succession of the Chinese leadership's adventurist lines and voluntarist decisions." In this way, he has wasted the masses' revolutionary energy on mass campaigns, rallies, slogans, eulogies and so forth.

To show that Mao never really trusted the masses and never sincerely believed that it was possible to learn from them, the Soviets quote his 1958 statement that "it has always been so in history that the majority followed the minority, because the minority reflected the views of the majority." Such "quasi-revolutionary logic" shows a clear lack of understanding of the dialectics of revolution, they say. Mao believed that man's inborn egotism, which is identical with the bourgeois frame of mind, will once again come to the fore as soon as the socialist system of production is established. Since the cadres of the Communist Party reaped the greatest gains from the progress made under the new regime, they were the ones who exhibited the greatest degree of "bourgeois degeneration" and egotism, according to Mao. For him, stability equated with inequality which, in turn, led to revisionism, so that building up the country's economic and technical base was equivalent to making the people "bourgeois."

B. Absence of Material Incentives

The Soviets maintain that China had every opportunity to develop according to a socialist model by rationally utilizing her resources and industrial base, by making use of the experience of the workers in revolutionary battle and the enthusiasm of the masses, and by taking full advantage of the experience and material aid willingly provided by all the governments in the socialist system. Depending on the specific source, China did this until 1956 (cooperativization of agriculture) or 1958 (Great Leap Forward) when Mao repudiated the progress that had already been made and rejected Soviet socialism as having grave sociopolitical defects—in part because it was based on material incentives. The ensuing shift in emphasis from the city back to the countryside and from heavy to light industry weakened the role of organized workers, while the wide utilization of labor armies was a repudiation of technology, which is so indispensable to social progress but which Mao never fully understood or appreciated. He yearned for the Yenan model, in which material provisions were uniform and which provided for the minimal requirements in food, clothing, and housing of the population. Anything more than the minimal impaired man's moral and even physical health. Mao was convinced that the wage system of the urban working class caused it to be deeply entrenched in "bourgeois law" and therefore more corrupt in ideological and econimic terms. According to the Soviets, only the poorest peasants could accept Mao's ideal of a "sound and simple life."

Since Lenin believed that socialism cannot be built on enthusiasm, the Soviets cannot accept Mao's egalitarian policies, which emphasize moral over material incentives. They say that Mao, like China's poor peasants, looked at the more complex forms of social production as alien, obscure, and hostile, and note his penchant for pointing to the PLA as brilliant proof that rapid growth in production can be achieved through correct ideology, rather than by emphasizing equipment, skilled workers, efficient management, engineers, and technicians. By opposing cash wages and piece rates, Mao attempted to bypass the logically necessary socialist stage in the drive toward communism and ignored the law of "scientific communism" which holds that material equality can only be achieved after the necessary production level has been reached.

The way some of the Soviet authors discuss Mao's ideas on wages and incentives might very well convince a reader unfamiliar with conditions in China that there is no graduated wage system for urban workers. It is difficult to glean from these writings that while the principle of distribution according to work was attacked, it was never really abolished and that even the Cultural Revolution did not eliminate wage differentials, so that with the exception of commune agriculture, ranks and grades have continued to exist in all sectors of the economy, from industry to government to education, and even to the model People's Liberation Army. Could it be that, despite his romanticism, Mao was practical enough to perceive just what the Soviets accuse him of being unwilling or unable to recognize—that modern large-scale and highly mechanized production cannot be developed without differential wages and earnings?

C. Deficiencies in Planning and Management

Another major theme in Soviet critique of China's economy since 1958 is the absence of what Lenin considered to be of primary importance to socialism: centralized planning and management on a national scale, with unified standards in production and distribution. They contrast this with Mao's views on planning, as he expressed them in 1957:

> Every year our country draws up an economic plan in an effort to establish a proper ratio between accumulation and consumption, and achieve a balance between production and the needs of society * * *. By the end of each year, such

> a balance, taken as a whole, is upset by the struggle of opposites, the unity achieved undergoes a change, balance becomes imbalance, unity becomes disunity, and once again it is necessary to work out a balance and unity for the next year. This is the superior quality of our planned economy. As a matter of fact, this balance and unity is partially upset every month and every quarter, and partial readjustments are called for.

Not surprisingly, the Soviets believe this to be "a vulgar view of Marxist dialectics" invented by Mao to provide a theoretical foundation for faulty economic management, which continues to be pursued by the post-Mao leadership. They find it incredible that Peking can proclaim 1976 as the first year of the Fifth Five-Year Plan, without publishing any data on the fulfillment of the Fourth Five-Year Plan, on the guidelines for the Fifth Five-Year Plan, or even on the results for 1976 and plan for 1977.

Actually, Mao expressed contradictory views with regard to centralized planning. Sometimes he spoke of its virtues in creating a balanced economic growth; at other times he posited that, in order to increase independence and encourage self-sufficiency, it is necessary to extend planning responsibility to the regions and local areas. The Soviets see Mao's renunciation of central economic planning in 1958 and the subsequent decentralization of economic management as playing havoc with China's economy. Some of their authors do make passing reference to the 1961–65 period when the P.R.C. made an effort to restore some of the socialist principles of managing and organizing the national economy, but usually this period is ignored, and the analysis of China's economy generalizes from the policies which prevailed during the Great Leap and the Cultural Revolution and which in some respects lingered into subsequent years.

Why did Mao transfer so much of the industry to the jurisdiction of local organs and why did he insist on self-sufficiency and reliance on one's own resources? Because, say the Soviets, by freeing the state from having to finance local development and distribute goods within the country, China was able to maximize the resources that could be used in building up China's military capability. In this regard, one Soviet author likens China's central authority to the beekeeper who extracts all the surplus honey from the hives, leaving the bare minimum for the producers of the economic goods.

Attempting to develop China without coordinated and integrated plans which could identify the needs and actual possibilities of the economy, upset the interbranch and intrabranch balances and resulted in a lopsided approach to economic problems—one that was highly wasteful of material and manpower resources. These "disproportions" are a common theme in Soviet analyses of individual branches of production. The self-sufficient, closed communes and other production units had only weak and inexperienced planning apparatuses plus a shortage of local resources and technical know-how. They found it extremely difficult if not impossible to cope with economic problems without financial, managerial, and technical assistance from the central government. The development of "democracy" at the commune and enterprise levels brought out parochial tendencies and perverted forms of local government. The Soviets never seem to explain how China's highly touted military strength, built up by leeching on the rest of the country's economy, can coexist with what they consider to be an appallingly inefficient and weak hinterland.

As believers in the one-manager approach in economic administration, the Soviets express their strong opposition to shared responsibility, such as management by revolutionary committees. Mao, however, felt that the one-man command system introduced during the First Five-Year Plan was unfit for China because it did not recognize the Party's leading role in the enterprise and failed to meet the "politics in command" requirement. In this connection, by the way, there is a common contradiction in Soviet writings. Some authors say that a serious problem in China's economy stems from Mao's having given too much responsibility to the masses who know nothing of either management or technology. Others, however, believe that under China's military bureaucratic regime, it is impossible for the masses to take a conscious part in running production. Since these statements never appear side by side, the Soviets do not feel the need to elucidate. They do, however, explain that when it comes to the relationship between workers and administrators, the Soviet Union follows Lenin's dictum that while every representative of the masses must be able to participate in the discussion of state laws, this does not mean that "we shall permit the slightest chaos or disorder as regards who is responsible in each individual case for definite executive functions * * *." In other words, lip service is OK, but keep administrative power out of the hands of the masses.

One very common complaint about China's economy refers to Mao's "two-leg" approach to development, which precludes what the Soviets refer to as "scientific planning." The simultaneous development of modern and traditional means of production runs counter to the Soviet passion for bigness. Since the emphasis should always be on heavy industry, the Soviets are particularly critical of China's development of small-scale rural industries throughout the nation. Actually, on several occasions Mao stated that his "model," which stresses development both "from the top and from the bottom," is necessary only during the transition period, while China's most abundant resource are people. Eventually, he believed, the emphasis must shift in the direction of "large and modern" industries, just as the Soviets would prefer it. Russian sources avoid mentioning this point just as faithfully as do the more rabid admirers of the Mao model in the West.

Virtually all Russian sources on Maoist economic planning (or lack thereof) discusses the so-called doctrine of "wavelike development" which, to the Soviets, falls in the category of Mao's "highly vague and primitive theoretical formulas." It is true that Mao wrote of "wavelike development" and that the Chinese press has echoed him with such statements as "socialist economic development is not a straightforward advance, but is a wavelike movement, a process of spiral ascent," and "wavelike advance is an objective law independent of men's subjective will." The Soviets take this "Chinese discovery" literally, pointing to the Great Leap and the Cultural Revolution as examples of how China implements this concept, which is referred to as Mao's economic law. Conversely, Western literature tends to look at the Great Leap and the Cultural Revolution as aberrations in the long-term economic growth of the P.R.C.—periods when overriding political considerations (albeit inspired by Mao's theories) caused serous but temporary setbacks to China's economic development. In other words, Moscow is inclined to reverse the cause and effect in China's economic ups and downs. A few Soviet authors admit to the likelihood that the "law" was developed to justify China's economic setbacks, that it has nothing to do with dialectics and shortcomings. Nevertheless, they still insist that "wavelike development" is presented by the Maoists as an objective law applying to all socialist economies. The Soviets understandably bristle at the suggestion that socialist economies follow the very same cyclical patterns that they criticize in capitalist countries.

D. Militarization of the Economy

Undoubtedly the most important theme recurring in Soviet texts on China contends that militarization is the primary characteristic and the foremost priority of China's economy. An accusation, by the way, identical to that hurled by China against the Soviet Union. Peking accuses the "Soviet bosses" of developing a lopsided war economy in order to achieve a military supremacy of the world. Although the Soviet gross national product is half that of the United States, because of "rapid military expansion and war preparations," the military expenditures by "the new tsars" far surpass those of the United States. The rhetoric makes it difficult to determine just "who struck John." But let us return to the Russian side of the story.

While the true military-bureaucratic nature of China's regime may not have been fully appreciated (or expressed) by the Soviets until the start of the Cultural Revolution in 1966, their retrospective analyses insist there was never any doubt, after 1958, that the militarization of the Chinese nation was the principal component of Mao's long-range strategy. The mobilization of people into labor armies to work on irrigation, roadbuilding, and mining projects was motivated more by military than by economic considerations. The herding of hundreds of millions of peasants into communes (almost always with quotes around the word—to imply that they are not really communes), where they were divided into regiments, companies, and squads, was to expose them to collective life under a military discipline. From these and other examples of militarization during the Great Leap period, the Soviets usually skip directly to the last half of the 1960's and the Cultural Revolution. Here, of course, even aside from the "frontier provocations against the U.S.S.R.," they have a more fertile ground for their accusations against China. The Soviets go into great detail about Mao's utilization of the PLA to "smash" the constitutional government organs and party committees in order to assume complete control over the country and establish his military-bureaucratic dictatorship. The result was that the role of the PLA became dominant not only in politics, but also in China's economy, while the role of the Party and the Government "was reduced to zero." The picture of economic chaos is drawn on the basis of numerous generalizations from "worst case" examples about specific plants and enterprises which were directed by the military.

In 1971, Mao realized that the PLA was becoming a threat to his own position, but although he purged Lin Piao and a number of other military leaders, the army continued to exert a very significant political and economic influence in the country. As late as 1977, Soviet sources maintain that the PLA, bolstered by its control over the militia, is the major force guaranteeing national stability through its control over the state of affairs in China.

The present Chinese leadership is said to divide the economy into two sectors: the military and the civilian. The first is provided with all the material and financial resources and all the specialized manpower necessary to assure a modern industry. In this sector, priority is given to research and development on and production of atomic weapons and missiles; even the budget of the Chinese Academy of Sciences was placed under the military, according to the Soviets, in order to speed up the nuclear armament program. The civilian sector, which produces consumer goods and supports agriculture is based essentially on primitive technology, however, and must depend on limited local resources.

Let's examine just a few of the many additional specifics used by the Soviets to illustrate their point. They note China's efforts, for many years now, to make every province self-sufficient in case of war and her strategic distribution of industry within each province. Militarization, they say, is evident in China's foreign trade by the strategic goods she imports from the countries of the West, especially from the NATO countries—a meaningful use of the military alliance rather than of the individual countries making up NATO. Finally, the Soviets maintain that three-fourths of all funds for scientific research go into work on nuclear and missile programs. "Is this the way to build a socialist society?" they ask.

In addition to criticizing China's military economy, it must be assumed that the Soviets are also doing some serious work on measuring China's defense (war) expenditures—albeit precious few statistics on this subject turn up in published books and articles. For the 1953–58 period all Soviet sources quote the figures released by the Chinese in *The Ten Great Years*, that is, a military budget of 5,000 to 6,000 million yuan. After the Great Leap, although China's economy was on the verge of catastrophe, "Maoists doggedly steered toward the country's militarization." The figures that were quoted by the Soviets in the 1960's were estimates almost exclusively of foreign origin (usually American); sometimes the source was cited, more often there was only indirect reference to "foreign research centers" or "foreign specialists." Vyatsky, for example, refers to "foreign research centers" when stating that in 1966 China's military expenditures totalled nearly 15,000 million yuan, that in 1967 she spent almost three times more money than in 1960 for military purposes, and that China began (late 1960's?) to spend 10 percent of her national income on militarization—a figure fairly commonly used in the West as the upper limit of a range.

In the 1970's the Soviets decided that Western estimates no longer served their purpose and started publishing their own inflated and well-rounded figures. Although occasionally Soviet sources use the figure of 33 percent, the most frequent recent claim is that the direct military spending accounts for more than 40 percent of China's state budget and that half of this amount is earmarked for the missile and nuclear weapons program. The much higher estimates are undoubtedly the result of ideologically motivated post-Cultural Revolution changes in definition. The Soviets now include not only all heavy industry and modern industry (overlapping categories) under the military budget, but, it seems, an overwhelming proportion of nonagricultural imports from capitalist countries, especially from Western Europe, are also categorized as strategic military goods. This is why the Russians are able to say that China's military budget is several times higher than the investment in industry. There simply isn't much left for the remainder of industry.[10]

Since what is subsumed under China's military budget is not spelled out by the Soviets, some authors seem to anticipate the readers incredulity and attempt to explain how a country with such a meager economy can spend one-third of the budget on the military. The explanations are rather feeble. They say that China is able to spend so much money on war preparations by squeezing out all the surpluses from the already impoverished peasants and by maintaining the low wage scale of the urban workers; wages which, they say, were even further reduced during the Cultural Revolution. The Soviets also claim that Peking was able to reduce state allocations for public education, culture, health services and other social needs of the working people ("An assault on their vital rights") by transferring the costs of these services from the state to the local budgets of the communes and brigades. And in this connection, it is difficult to understand how the Soviets can suggest (and they do) that one of the reasons Mao shook up China's educational system was to be able to spend more on military technology, at the same time that they rightly point out that the closing of all the institutions of higher education during the Cultural Revolution has weakened China's economy. Nor did the introduction of cooperative health care into the rural areas (which is indeed supported by the peasants themselves), reduce the national health expenditures. It is well known that the state health budget did not reach most of the peasants even before the Cultural Revolution; it did and still does reach the *hsien* (county) and even the commune level where state-supported health facilities are maintained for use by peasants. Chances are that China's health budget has increased since 1970.

In a sense, the Chinese themselves are to blame for the exaggerated Soviet estimates of China's military budget. Certainly the innumerable slogans and proclamations issued by Peking during the past 10 years could lead to the deduction that China's economy is entirely war oriented. But while a very literal interpretation of Chinese statements can be expected when the vehicle is propaganistic, but when Soviet China scholars also uncritically echo Peking's often hysterical bluster, one wonders, once again, about their perspicuity and objectivity.

V. Performance of Individual Economic Sectors

Having reviewed the U.S.S.R.'s scholarly and ideological setting for the study of Chinese economy, let us now take a look at how some Soviet analysts evaluate the performance of the more important sectors within the economy. Because both Soviet and Western China watchers have essentially the same limited data on which to base their estimates and because the basic cycles in China's economy are not in dispute, it is not surprising that in their broadest terms there is little difference between the two sets of estimates. However, a closer look at some of the figures and presumptions presented in this section reveals divergencies which could be of special interest to those concerned with analyses of specific economic sectors.

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[10] The Chinese, incidentally, use a similar approach in measuring Soviet military budget. They state that 19.6 percent of the Soviet national budget is allocated to military spending, that 60 percent to the industrial enterprises support military purposes and that 85 percent of industrial investment goes to the production of capital goods—"mainly to sectors connected with armament production." (*Peking Review*, Jan. 30, 1976, pp. 10-11.)

A. Population

Population, of course, is not an economic sector, but because it is so important in measuring China's economic progress, this seems an appropriate place for a brief review of the subject.

As with other types of data, the Soviets had no problems with China's population in the 1950's. They never published any critical analysis of the figures released by the Chinese. After the 1960 break between the two countries, the Soviets continued to use the general purpose population figures from the 1950's, usually 600 or 650 million, or the more precise but out-of-date 646 million, which was reported for 1957 in the *Ten Great Years*. By the middle of the decade, some authors also began to use population estimates published by the United Nations and by Western demographers. Thus, during the first two decades of P.R.C.'s existence it is difficult to find a single Soviet estimate of China's population in a published Russian source.

The weakness of Soviet demographic studies on contemporary China was readily admitted at the 1971 Moscow conference of Sinologists. Whereas Soviet sinologists, and especially those who are also economists, are keenly aware of the importance of China's population to the whole range of China studies, E. A. Konovalov, a leading China demographer, complained that the number of special works devoted to the problem of population has declined sharply "during the past years." Since there was precious little population work to start with, the foreign observer might find it difficult to discern a decline, but the post-1970 emphasis on population is quite evident. Soviet scholars are now presenting not only estimates of Chinese population, but also some of their thinking behind these estimates. As one might expect of Marxists, there seem to be general agreement that the solution to China's population problem lies in economic development and not in population control, which receives little attention from Soviet demographers. At the same time, there are only infrequent rebuttals to the notion that population pressures are responsible for some of China's aggressive international policies. Based on some of the population series published since 1970, it is clear that Soviet demographers are not in agreement about the trends in China's population. It is also evident that the Soviets have as difficult a time as their Western contemporaries in keeping up with China's population developments; the Soviets too tend to change their estimates as new information becomes apparent. The two sets of population estimates selected for inclusion in table 1 are by Konovalov, a frequent author on Chinese demography, and by Molodtsova.

TABLE 1.—SOVIET ESTIMATES OF CHINA'S POPULATION

Year	Konovalov		Molodtsova	
	Population	Growth rate	Population	Growth rate
1949	541.6			
1950	551.9	1.9		
1951	563.0	2.0		
1952	574.8	2.1		
1953	587.9	2.3	566.3	
1954	601.7	2.3	579.4	2.3
1955	616.6	2.5	592.4	2.2
1956	632.8	2.6	605.1	2.1
1957	647.0	2.2	623.2	3.0
1958	559.0	1.9	635.7	2.0
1959	(672.0)	(2.0)	645.2	1.5
1960	686.0	(2.1)	651.7	1.5
1961	692.0	.9	655.6	.8
1962	698.0	.9	661.1	.0
1963	702.0	.6	674.3	2.6
1964	715.0	1.9	691.2	2.8
1965	729.0	2.0	705.0	2.0
1966	739.0	1.4	717.7	1.0
1967	750.0	1.5	730.6	1.8
1968	761.0	1.5	745.3	2.0
1969	772.0	1.4	760.9	2.1
1970	785.0	1.7	776.9	2.1
1971	797.0	1.5	792.4	2.0
1972	809.0	1.5	806.7	1.8
1973	820.0	1.4	821.2	1.8
1974			836.0	1.8

Sources: E. A. Konovalov, "Demographic Characteristics," in M. I. Sladkovskiy, et. al. (eds.), "Kitayskaya Narodnaya Respublika: Politicheskoye i Ekonomicheskoye Razvitiye v 1973 godu" ("Chinese People's Republic: Political and Econonic Development in 1973") (Moscow: Nauka, 1975), p. 37. The year 1959 was omitted by author or printer; the figures in parenthesis are interpolations. A. I. Petrov and L. I. Molodtsova, "Ekonomika KNR: vozmozhnosti i real'nost' " ("Economy of the PRC: Possibilities and Realities") (Moscow: Nauka, 1976), p. 46. Hereafter referred to as Petrov and Molodtsova.

The figures in table 1 provide an excellent opportunity for some detailed "table climbing." For the present purpose, however, it is sufficient merely to make a few generalizations—in part implied, because neither author provides us with the estimates of birth and death rates which produced the population totals. Konovalov's figures reflect his belief that during the 1950's the average marriage age in China decreased and the number of births increased, and that during the 1960's, there was a sharp drop in the birth rate because of a rise in the age at marriage and some mysterious legal restriction that allowed no more than two children per family. Molodtsova accepts the Chinese figures for the 1950's, assumes that the provincial figures in the *World Atlas*, published in Peking in 1972, represent the results of a "1964 census" and accepts the total as a benchmark, and makes her estimates since then by considering "the internal political situation in in the country and China's demographic policies." Both authors, as do all Soviet demographers, assume an extremely high level of mortality following the Great Leap, essentially ignore any discussion of China's family planning policies, and show much more drastic annual fluctuations in the rate of natural increase than is common in the West. Finally, it is interesting to note that while on the low side, current Soviet estimates differ little from some of the estimates made in the West, albeit the Soviets arrive at their population totals by very different routes.

A few other miscellaneous statistics dealing with China's population and labor force are discussed by Molodtsova. She includes provincial distributions of China's population for 1953, 1957, 1964 and 1974. For 1953, she uses the census figures; for 1957, the figures from *The Ten Great Years;* for 1964, the provincial totals reported in the Peking-published 1972 *World Atlas;* and for 1974, she uses the 1964 proportions to distribute by provinces the previously estimated total of 836 million. She estimates that in 1974 China had 483.2 million people of working ages (probably 15 to 59) constituting about 58 percent of the total population, and that of this total 106.3 million, or 22 percent, resided in urban areas. For the same year the number of people employed in rural areas was 280 million, of whom about 250 million were engaged in agriculture. The total number employed in nonagricultural pursuits was 100 million—65–70 million in the cities and 30 million in the rural areas. In general, Molodtsova estimates that about 70 percent of the 15–59 age group may be considered to be part of the labor force. She also estimates the 1974 urban population at about 170 million, or 20 percent of the total population.

B. Agriculture

Before proceeding to the more serious Soviet analysis of China's agriculture, let us quickly summarize the agriculture-related rhetoric, which appears in virtually all Soviet discussions of rural China. Most of the important factors which are said to be impeding China's agricultural progress and creating rather "desperate conditions" in the rural areas, relate to the militarization of the economy. Peking's heavy financial allocation to increased military capability leaves little if any material or financial aid to the countryside and, by insisting on rural self-sufficiency, it is attempting to develop China on the shoulders of the Chinese peasants. While squeezing the utmost from the peasants, Maoists have been extolling the philosophy of poverty and exhoring the peasants to "rejoice in their poverty." At the same time, "demogogic slogans" to "prepare for war, famine and natural disaster" intend to whip up peasant enthusiasm. On top of all the other burdens heaped on them, the peasants are expected to support tens of millions of urban youth who have been forcibly resettled in the countryside. All this, according to the Soviets, has resulted in a drop in the farmer's living standards and, not unnaturally, has led to a sharp decline in labor discipline and agricultural productivity.

Unfortunately, a considerable amount of polemic is also present in the more scholarly analyses of China's agriculture, but herein lies a question: How much of what we would consider to be rhetoric is included as a prerequisite for publication and how much is a uniform conviction of the Soviet authors? Despite China's emphasis on agriculture, there seems to be little doubt that most Soviet economists do believe that Peking neglects rural development, that state aid is available only in periods of crisis, that local self-sufficiency is a ridiculous policy and that military priorities are the cause of China's poor agricultural performance. In the final analysis one must balance the extravagance of the verbal attacks with the competence and affiliation of the individual author and then make a subjective judgment.

The first agricultural differences between Soviet planners and the policies pursued by Mao occurred in 1956. Prior to that date, there was a general understanding between the Chinese and their Soviet advisers that the basic goals in agricultural development should be cooperativization of the peasants and the introduction of mechanization. The first was to be achieved in about 15 years and the second during the course of some four or five 5-year plans. By insisting on forced coopertivization in 1956 Mao destroyed the carefully planned agrarian revolution and set the stage for the Great Leap and the establishment of his communes. Soviet authors delight in writing about this period, for it clearly demonstrates to them everything that is wrong with the Maoist system. The abolition of incentives, the depersonalization of the individual peasant worker, the militarization of the rural labor force—all subverted the enthusiasm and faith of the peasants in socialist production. At the same time, the introduction of agro-technical measures which had no scientific basis, seriously damaged agricultural production. The Soviets almost never mention the natural disasters which contributed to the drastic decline of agricultural production at the turn of the decade.

Since the deviation from the radical Maoist Great Leap line was already under attack in China in the 1961–63 period, the Russians believe that the advent of the Cultural Revolution was a logical progression from the "Great Leap" and the establishment of communes. Although the Soviets admit that the Cultural Revolution did less harm to agriculture than to industry and transportation, their description of the considerable damage to the countryside and to agricultural production includes some unusual interpretations. Concerned about Peking's policies and slogans, say the Soviets, peasants in some of the provinces began to divide up among themselves public funds, cattle, grain, and even seed; they abandoned their work of building and repairing dams and irrigation networks; and they refused to work on the central plan. The danger of peasant refusal to sow and harvest grain in 1968 forced the Maoist leadership to send large numbers of military, cadres, employees of state institutions, and youth from secondary and higher educational instititions to the countryside. It was the influence and controls exerted by these groups, as well as the introduction of certain economic stimulants, that finally improved agricultural productivity. It is indeed curious that the Soviets would suggest that the unhappy urban cadres and students, who were sent down to the countryside against their will, dispelled some of the peasants' concerns and provided the necessary stability for increasing agricultural production. Furthermore, this theory contradicts their own sound assessment that deported urban youth were viewed by the peasants as an additional burden.

The Soviets maintain that the Tachai-type communes promoted by the Chinese since 1975 will make it easier for Peking to manipulate the material and manpower resources of the countryside and thus to gain total control over the rural population. As during earlier periods, however, the Soviets continue to expound the view that all of the proposed solutions to China's rural economic problems are ineffective and are being "resisted more and more" by the Chinese peasant.

The Soviets are very skeptical about the innumerable reports from China about the reclamation of land through desalinization, terracing of slopes, et cetera. At the same time, one of the explanations they suggest for a Chinese report that cultivated land in 1973 was 4.8 million hectares less than in 1957, is that Peking consciously reduced the cultivated arable land area in order to show improvements in agricultural productivity. Some Soviet specialists also believe that the low level of mechanization and the absence of large capital investment make it impossible for China to fully utilize even the area which was cultivated in 1957. They remind the reader that the battle against erosion and improvement of cultivated lands through irrigation, better drainage and leveling requires more than the hard work of peasants; it requires specialists with a good scientific and technical foundation, something the Chinese are very short of. The measures that did increase productivity in China's agriculture were, according to the Soviets, the improvement of seed varieties, the increase in the cropping coefficient and a greater utilization of chemical fertilizers. Table 2 presents some estimates of China's "agrotechnical level."

TABLE 2.—AGROTECHNICAL LEVEL OF CHINA'S AGRICULTURE

	Units	1952	1957	1965	1970	1974
Tillable land	Million hectares	99. 4	103. 0	107. 0	107. 0	110. 0
Land under crops	do	130. 1	144. 8	149. 8	160. 5	165. 0
Doublecropping coefficient	Percent	130. 9	140. 0	140. 0	150. 0	150. 0
Workers in agriculture—in full man-year equivalents.	Millions	99. 5	109. 3	123. 1	134. 6	146. 0
Cultivated land per worker in agriculture	Hectares per person	1. 31	1. 32	1. 22	1. 19	1. 13
Irrigated land	Million hectares	15. 0	23. 0	35. 0	40. 0	45. 0
Percent irrigated	Percent	15. 1	22. 3	32. 7	37. 4	40. 9
Draft animals	Million head	76. 5	83. 8	76. 0	84. 0	91. 0
Draft animals per 1,000 hectares of cultivated land	Number	588. 0	579. 0	507. 0	523. 0	551. 0
Tractors (15-hp units)	Thousands	2. 0	24. 6	154. 2	210. 0	300. 0
Tractors per 1,000 hectares of cultivated land	Number	. 02	. 17	1. 03	1. 31	1. 82
General availability of mechanization and electrification.	Million horsepower	. 03	. 56	11. 0	30. 0	40. 0
Mechanical and electrical energy per 1,000 hectares of cultivated land.	Horsepower	. 2	3. 9	73. 4	186. 9	242. 4
Use of organic fertilizer	Million tons		1. 9	8. 0	18. 3	30. 0
Use of organic fertilizer per unit of cultivated land	Kilograms per hectare		13. 1	53. 4	114. 0	181. 8

Note: It seems strange that the area under crops is larger than the tillable land area. It is difficult to say whether there is a reasonable explanation or the figures were simply inadvertently reversed.

Source: Petrov and Molodtsova, p. 134. Most of the figures for 1952 and 1957 are from "The Ten Great Years"; some of the figures for 1965 and 1970 are U.S. estimate; most of the other figures are estimated by Molodtsova.

Until the publication of Molodtsova's figures, all Soviet sources carried pretty much the same estimates of China's grain production: official Chinese statistics through 1957 and significantly lower estimates than by most Western specialists, since 1960 (see table 3, col. 1). The often drastic upward revision of the earlier Soviet estimates by Molodtsova (table 3, col. 2) more than closed this gap: for 12 of the 25 years covered by the estimates, her figures of China's grain production actually exceed the CIA estimates (table 3, col. 3). Her imaginative methodology (uncharacteristic for Soviet sinologists) for arriving at the grain estimates for the 1957–73 period is presented in table 4. The implications of the new figures suggest two somewhat contradictory observations. On the one hand, they tend to negate the universal Soviet contention of severe food shortages in China; on the other hand, by inflating the base 1949 grain production, the new estimates tend to reduce the average annual rate of increase in grain production over the 25-year period—placing it only slightly ahead of population growth.

TABLE 3.—PEOPLE'S REPUBLIC OF CHINA GRAIN PRODUCTION: A COMPARISON OF U.S. AND SOVIET ESTIMATES

[Million metric tons]

	Soviet estimates		
	Most frequently cited [1]	Molodtsova [2]	U.S. estimates [3]
1949	108	134	111
1950		144	130
1951		155	141
1952	154	166	161
1953		170	164
1954		160	166
1955		175	180
1956		175	188
1957	185	185	191
1958		201	206
1959		173	171
1960	160	160	156
1961		167	168
1962		181	180
1963		185	190
1964		195	194
1965	185	201	194
1966		212	215
1967		218	225
1968		212	210
1969		218	215
1970	210	232	243
1971	220	241	246
1972	210	235	240
1973	220	249	266
1974			275
1975			284
1976	240		285
1977			

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[1] With the exception of 1976, the figures are from Z. I. Muromtseva, "Agriculture," in M. I. Sladkovskiy et. al. (eds.) "Kitayskaya Narodnaya Respublika: politicheskoye i ekonomicheskoye razvitiye v 1973 godu" ("Chinese People's Republic: political and economic development in 1973") (Moscow: Nauka, 1975), pp. 153–164; the figure for 1976 is from I. Korkunov, et. al., "China's Economy in 1976," "Far Eastern Affairs," No. 2, 1977, p. 24. Estimates are said to be based on Chinese and foreign sources.

[2] Petrov and Molodtsova, p. 145.

[3] Central Intelligence Agency, National Foreign Assessment Center, China: Economic Indicators, October 1977 (ER 77–10508), p. 11. There are, of course, many other grain production series that might have been selected to illustrate the general magnitude of Western estimates.

TABLE 4.—EFFECTS OF WEATHER, TECHNOLOGY AND POLITICAL FACTORS ON CHINA'S GRAIN PRODUCTION

	Optimum harvest for weather conditions		Influence of agrotechnology		Possible harvest under existing agrotechnology and weather conditions (million tons)	Effects of political changes and degree of labor intensity (percent)	Grain production (million tons)
Year (weather conditions)	Deviation from average (percent)	Million tons	Effect of irrigation and other factors (percent)	Effect of fertilizer application (million tons)			
1957 (average)	100.0	182.5		2.5	185.0		185.0
1958 (good)	102.5	187.1	+2.5	3.9	195.7	+2.5	200.6
1959 (average)	100.0	182.5	−2.5	4.0	181.9	−5.0	172.8
1960 (bad)	97.5	177.9	−5.0	9.1	178.1	−10.0	160.3
1961 (bad)	95.0	173.4	−2.5	6.5	175.6	−5.0	166.8
1962 (good)	102.5	187.1	−2.5	7.8	190.2	−5.0	180.7
1963 (average)	100.0	182.5	−2.5	11.7	189.6	−2.5	184.9
1964 (good)	102.5	187.1	−2.5	13.0	195.4		195.4
1965 (average)	100.0	182.5		14.0	196.5	+2.5	201.4
1966 (bad)	97.5	177.9	+5.0	20.5	207.3	+2.5	212.5
1967 (good)	102.5	187.1	−5.0	21.3	217.8		217.8
1968 (average)	100.0	182.5	+5.0	25.5	217.1	−2.5	211.7
1969 (average)	100.0	182.5	+5.0	32.0	223.6	−2.5	218.0
1970 (good)	102.5	182.7	+5.0	35.0	231.5		231.5
1971 (average)	100.0	182.5	+7.5	38.5	234.7	+2.5	240.6
1972 (bad)	97.5	177.9	+7.5	43.9	235.1		235.1
1973 (average)	100.0	182.5	+7.5	52.5	248.7		248.7

Source: Petrov and Molodtsova, p. 142. Molodstova uses 1957 as the average year for weather and production. She estimates a 2.6 ton increase in grain production for every ton of fertilizer applied.

C. Industry

The Soviets describe the development of China's industry as complicated and contradictory, and they divide it basically into just two periods: 1949 through 1957 and 1958 to the present time. The first period, which includes the First Five-Year Plan and followed the prescribed Soviet line, showed rapid industrial growth and "laid a most favorable foundation" for the future successful development of China's industry. Then came the "adventurist policies" of the Great Leap with its emphasis on "mass construction of handicraft industries" in key branches of industry (for example, backyard steel furnaces), a drastic reduction in the quality of production, overintensive use of existing industries to the point of deterioration, and the absorption into industrial production of large numbers of subsidiary workers at the expense of other branches of the economy—especially agriculture.

In the late 1950's the Soviets reported China's Great Leap economic statistics without any commentary. It is difficult to say whether it pained them to do so or they actually accepted these inflated data. Now, of course, they concur with what is common knowledge in the West—that the official production statistics published for the Great Leap were gross exaggerations. Nevertheless, they maintain (not unreasonably) that the growth which occurred in 1958 and 1959 was due primarily to the completion of enterprises that were earlier initiated with the help of the Soviet Union. Soviet specialists give short shrift to the 1962–66 period. They say that at least the gross mistakes of the Great Leap were corrected and that by the end of 1962 the downward trend in industrial production was reversed. In general, by the mid-1960's conditions in China for a return to planned economic construction were good.

The Soviets estimate that the Cultural Revolution set back China's industrial development by 2 to 3 years. Most affected were the coal, metallurgical, and electric power industries; labor productivity and quality of production were also sharply reduced. It was not until 1969 that production once again reached the 1966 levels, and even then not in all the branches of industry.

The process of overcoming the consequences of the Cultural Revolution was slow and painful and the plan to achieve a 10-percent annual growth in production was obstructed by continuing political campaigns and conflicts between the pragmatists and the Maoists. The overall goal was the development of a national military-industrial complex (i.e., heavy and modern industry) and to obtain as much scientific and technological assistance as possible from the advanced capitalist countries. While Chinese industry (both national and local) had experienced growth in the 1970's, Peking has not been able to solve many of the fundamental problems that affect industrial development, such as insufficient raw materials and energy, outdated industrial facilities, and the shortage of qualified specialists. As a result, between 1960 and 1975 the gross industrial production did not increase by more than 3 percent per year.

Although Soviet and Western estimates of China's production figures may differ, there is actually little disagreement about the overall strengths and weaknesses of individual economic sectors or the specific problems facing the planners in Peking. The differences are in perspective, in emphasis, and in evaluations of the rationality (or muddleheadedness) of China's economic policies. The following review of the industrial sectors will be brief and dull; it will, where possible, emphasize the differences in Soviet and Western perceptions.

The Soviets believe that fuel and energy resources continue to be the weakest of many weak links in China's economic development and they single out coal (China's most important fuel) as the primary culprit. Among the most important reasons why coal production has not kept pace with the gross industrial production is the low level of mechanization and automation in the large coal areas of the north. While much of the increase in productivity in recent years came from the small and medium-size mines around the country, China's efforts to make the provinces south of the Yangtse self-sufficient in coal have not been successful and despite the discovery of new deposits, the Soviets believe that the costly north-south transport of coal will have to continue.

Although oil output grew more rapidly than the rest of China's industry, it still accounts for only 12 percent of the country's fuel and energy resources. According to the Soviets, one of the reasons that China speeded up the exploration for and development of petroleum was "to make ends meet" in her trade with "imperialist monopolies." A more rapid development of oil resources has been hampered, however by the inadequacies of China's refining capacities, storage facilities, and transportation facilities both to the refineries and to the areas of consumption. The development of new oil fields and the building of additional pipelines continue, but even though China reduced oil exports in 1976, the total production of petroleum goods are far from adequate to meet her domestic requirement. The greatest shortages are evident in the transportation field where there is a perpetual shortage of liquid fuels.

The Soviets consider the insufficiency and inefficiency of electric power—80 percent of which is still generated by coal-burning installations—to be the greatest problem in China's energy picture. Prospects therefore, depend to a large extent on increased coal production and the results of China's current efforts to improve and expand the old facilities. The Soviets concede that the most rapid growth in electric power occurred in the hydroelectric sector, but here as in other industrial fields, frequent criticism focuses on the size of the installations. They clearly favor the large stations, like those which were built on the Huang Ho cascade, and think it is economically wasteful to scatter small hydro stations throughout the countryside.

Both political and economic factors explain the "stagnant" state of China's iron and steel industry. Most of the recent increase in the production of steel and pig iron came from the construction of small and medium-sized plants, while the construction of large new plants necessary for China to reach a production level of 30 million tons of steel annually is handicapped by limited capabilities in heavy machine building and by the shortage of qualified specialists. The Soviets do believe, however, that China is capable of constructing one enterprise with 1-million-ton capacity every 3 years and a large combine with a 3- to 5-million-ton capacity every 5 years. The growth of many branches of the economy is being held up because China's metallurgy does not meet the country's needs in terms of quantity, quality or assortment of products. The Soviets conclude that even with the purchase of foreign metallurgical equipment, China will have to continue to import metals—especially high-grade steel—from abroad.

Although hampered by a shortage of construction materials (especially rolled steel), China's machine-building industry has made great strides. Because of military priorities, the greatest progress was achieved in electronics and precision machine-tools. Other priority fields in which China has concentrated her machine-building efforts are the mining, petroleum, chemical, and power industries, as well as a variety of industries which produce equipment for agriculture. However, the production figures can be deceiving, say the Soviets, because most of the machine-tool production goes for replacement of obsolete equipment. Furthermore, although the situation with small machine tools is relatively good, the production of large, automatic, and semiautomatic machine tools suffers from lack of planning. The policy of self-reliance and the weakness of communication between enterprises causes every machine-building plant to attempt to be a producer of machinery and of parts and, at the same time, to be a repair station for the area it serves. This, say the Soviets, is inefficient.

China's chemical industry has been emphasizing the production of fertilizers, pesticides, plastics, synthetic fibers, drugs, and chemical products of military significance. By modernizing old enterprises, China's petrochemical industry has experienced good growth, but the quality of production is well below world standards. The Soviets are adamant in their criticism of China's policy of building the technologically backward, small-scale chemical fertilizer plants which use low-quality raw materials and consequently produce low-quality fertilizer. Because of China's purchases of whole fertilizer plants from "capitalist countries," the overall situation in fertilizer production is deemed to be "relatively good" by the Soviets. As a matter of fact, they say that the future of China's chemical industry in general will depend to a large extent on the purchases of chemical installations from abroad.

The differences in the Soviet and Western estimates of China's cement production are so striking that one immediately suspects a definitional problem. This is, in fact, the case, but only one source was located which clarifies the difference. Although one must assume that the Soviets recognize the importance of small cement plants scattered throughout the countryside to provide local areas with low-quality cement for irrigation projects, telegraph poles, conduits, tile, and so forth, they exclude the production of these enterprises of local significance from the national estimate of cement production. The Soviets include only the production of large factories (many of them built with the help of the Soviet Union in the 1950's) which provide cement for capital construction in the most important branches of heavy industry and for military industrial needs. They maintain, however, that probably because of the national fuel shortage, these large cement plants are not being utilized to capacity.

China's light industry has been growing about one-third as fast as her heavy industry. The Soviets give several generally accepted explanations for this. Since light industry receives 70 percent of its raw materials from agriculture, any drop in the production of cotton, oil-bearing crops, and food crops is immediately reflected in the output of light industry. To reduce reliance on agriculture and to increase the area sown to food crops, China has been attempting to increase the production of synthetic fibers, but so far progress has been slow. Furthermore, because of limited investments, China's light industry is still largely based on old enterprises using obsolete equipment. In the food industry, for example, only sugar and tobacco production have experienced reasonable growth.

Table 5 compares Soviet and U.S. production estimates for selected basic industrial products.

TABLE 5.—OUTPUT OF BASIC INDUSTRIAL PRODUCTS: TABLE OF COMPARISONS[1]

	1958	1959	1960	1962	1965	1966	1967	1969	1970	1971	1972	1973	1974	1975	1976
Coal (million tons):															
A	228.0	296.0		200.0		245.0	170.0	225.0		280.7	300.0	325.0	340.0	365.0	376.0
B			344.0		235.0				360.0				400.0		
C	230.0	300.0	280.0	180.0	220.0	248.0	190.0	258.0	310.0	335.0	356.0	377.0	389.0	427.0	448.0
Oil (million tons):															
A	2.3	3.7		5.8		12.0	10.0	15.0		25.0	29.0	38.0	45.0	56.0	60.0
B			5.5		10.0				28.0				60.0		
C	2.3	3.7	5.1	5.7	11.0	14.1	13.9	20.4	28.2	36.7	43.1	54.8	65.8	74.3	83.6
Electric power (billion kilowatt-hours):															
A	27.5	43.5		35.0		70.0	55.0	65.0		77.0	83.0	92.0	102.0	115.0	125.0
B			50.0		55.0				85.0				135.0		
C	28.0	42.0	47.0	30.0	42.0	50.0	45.0	60.0	72.0	86.0	93.0	101.0	108.0	121.0	
Steel (million tons):															
A	8.0	10.5		8.0		13.0	10.0	13.0		21.0	23.0	26.0	25.0	25.0	21–22
B			15.0		12.5				18.0				23.0		
C	11.1	13.4	18.7	8.0	12.5	15.0	12.0	16.0	17.8	21.0	23.0	25.5	23.8	26.0	23.0
Chemical fertilizers (million tons):															
A	.5	1.3		2.4		8.5	7.5	9.0		16.8	20.0	24.0	26.0	30.0	33.0
B			2.0		7.7				10.0				14.0		
C	1.4	1.9	2.5	2.8	7.6	9.6	8.1	11.3	14.0	16.8	19.8	24.8	24.9	27.9	
Machine tools (thousand units):															
A	30.0	33.0		20.0		42.0	35.0	40.0		55.0	60.0	65.0	70.0	76.0	70.0
B			63.0		40.0				55.0				75.0		
C	30.0	35.0	40.0	25.0	45.0	50.0	40.0	55.0	70.0	75.0	75.0	80.0	80.0	90.0	

Motor vehicles (thousand units):															
A	16.0	19.0	----	18.0	----	52.0	40.0	50.0	----	60.0	65.0	70.0	82.0	92.0	80.0
B															
C	16.0	19.4	15.0	8.4	30.0	43.0	32.0	60.0	70.0	86.0	100.0	110.0	121.0	133.0	----
Cement (million tons):															
A	9.3	10.6	----	8.0	----	13.0	10.0	13.0	----	16.3	17.0	19.0	20.0	23.0	25.0
B	----	----	11.0	----	12.5	----	----	----	15.0	----	----	----	21.0	----	----
C	10.7	12.3	12.0	6.9	16.3	17.9	14.2	22.5	26.6	31.0	38.1	41.0	37.3	47.1	49.3
Cotton fabrics (billion meters):															
A	5.7	7.5	----	4.0	----	6.8	6.0	7.0	----	8.5	8.5	8.7	8.9	9.0	9.0
B	----	----	6.0	----	6.3	----	----	----	7.3	----	----	----	9.5	----	----
C	5.7	6.1	4.9	3.5	6.4	6.7	5.5	6.6	7.5	7.2	7.3	7.6	7.6	7.6	----
Sugar (million tons):															
A	.0	1.1	----	.7	----	1.6	1.7	1.7	----	2.0	1.9	2.2	2.3	2.5	----
B															
C	.9	1.1	.9	.5	1.5	1.7	1.9	1.7	1.8	1.9	1.9	2.2	2.2	2.3	----

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[1] Decimal points and zeroes were added to most Soviet estimates to facilitate comparisons; when appropriate, U.S. estimates were rounded to the nearest 10th.

NOTES

A. Standard Soviet estimates.

1958–73: V. I. Akimov et. al, "Industry," in M. L. Sladkovskiy (ed.), Kitayskaya Naordnaya Respublika: politicheskoye i ekonomicheskoye razvitiye v 1973 godu (Chinese People's Republic: Political and Economic Development in 1973) (Moscow: Nauka, 1975), pp. 134–140. For 1958–59 the source uses official Chinese data with the exception of coal, steel (1959), machine tools, and cement (1959). For 1962–73—"estimates of Soviet and foreign Sinologists."

1974–75: E. Konovalov, et al., "China in 1971–1975: Economics and Culture," Far Eastern Affairs, No. 2, 1976, p. 26.

1976: I. Korkunov, et al., "China's Economy in 1976," Far Eastern Affairs, No. 2, 1977, p. 14.

B. Molodtsova estimates.

Petrov and Molodtsova, p. 114. Only source to specifically state that the production of traditional Chinese enterprises is excluded from the estimates. This accounts for the lower estimates for chemical fertilizers and cement.

C. U.S. estimates.

Central Intelligence Agency, National Foreign Assessment Center, China: Economic Indicators, October 1977 (ER77–10508). There are, of course, many other estimates that might have been used. Among other reasons, this source was selected for its comprehensiveness and convenience

D. Transport

Soviet evaluation of China's transport differs little from the fairly universal opinion that while considerable modernization has been achieved, it remains in a rather backward state and exerts a braking influence on China's economic growth. Transport by means of human and animal power continues to play an important role in the economies of local areas, as it has for thousands of years. The Soviets believe that all sectors of China's transport would have progressed quicker, as would have her overall development, were it not for the "adventurist experiments" in economic development imposed on the country by Maoist leadership during the Great Leap and Cultural Revolution.

The development of railways lagged behind the needs of the national economy and their efficiency was especially affected by the periodic political upheavals. Much of the rolling stock is obsolete, making it difficult for railroads to cope with the increased volume of freight, particularly with heavy industrial cargoes. Some of the problems identified by the Soviets as unfavorably affecting China's rail transport include the lag in the iron and steel industry, the low level of the transport engineering industry, and the laying of new track in low density, industrially undeveloped areas, while giving little attention to modernization and increasing traffic capacity in areas where the economic needs are the greatest. The purchase by China of locomotives, tank cars, and other railroad equipment from European nations should help, but in no sense will these purchases solve the multiple problems of China's rail transport.

In recent years China has been concentrating on building and expanding existing ports and facilities for both river and oceangoing transport, greatly increasing the cargo-handling capability in the country. Shipbuilding has also been greatly expanded and supplemented by purchases from abroad. While China is still unable to meet all her requirements for domestic transport and foreign trade, the Soviets apparently accept the Chinese claim that in 1976 over 70 percent of China's import-export freight was transported in Chinese bottoms.

China's road system would be in much better shape, say the Soviets, if Peking did not spend so many resources on roadbuilding for strategic rather than economic considerations. Emphasis on border regions has resulted in the construction of roads close to the territories of Nepal, Pakistan, and Laos in the early 1960's and in the border areas adjacent to the Soviet Union, North Vietnam, Burman and Laos in the late 1960's.

Because transportation machinebuilding is especially weak, the Soviets maintain that Chinese industry is still unable to meet the country's needs for locomotive, specialized railroad cars, trucks, ocean vessels, and various other transportation equipment. Engines for locomotives, ships, and land vehicles are still manufactured in units rather than in series. This is due not only to the relative immaturity of Chinese industry, but also to China's policies of self-reliance and self-sufficiency.

Table 6 presents Soviet estimates of the length and performance of China's rail, highway and river networks. While the U.S. and U.S.S.R. figures for the length of rail and river networks are almost identical, by 1976 the U.S. estimate of China's highway network becomes about 15 percent higher. Even though both countries accept the 1957 and earlier Chinese figures for the performance of the transportation system, with one exception the U.S. estimates of freight carried and freight turnover are significantly higher.

TABLE 6.—TRANSPORTATION NETWORKS AND PERFORMANCE

Unit	1957	1960	1965	1970	1971	1972	1974	1976
Length of network (thousand kilometers):								
Railroads	29.8	33.0	35.0	40.0	41.0	42.0	45.0	47.5
Highways	254.6	500.0	550.0	650.0	670.0	670.0	626.5	760.0
Navigable rivers	144.1	150.0	--------	--------	150.0	150.0	150.0	--------
Freight Tonnage (million tons):								
Rail	274.2	470.0	490.0	570.0	620.0	660.0	800.0	836.0
Road	83.7	198.0	210.0	240.0	260.0	280.0	340.0	--------
Water	53.8	66.0	70.0	81.0	88.0	94.0	110.0	--------
Freight turnover: (billion tons per kilometer):								
Rail	134.6	228.0	240.0	280.0	304.0	326.0	400.0	420.0
Road	3.9	15.0	16.0	18.0	20.0	21.0	26.0	--------
Water	34.4	53.0	56.0	66.0	71.0	76.0	94.0	--------

Sources: 1957–72: KNR: Politicheskoye i ekonomicheskoye razvitiye v 1973 godu, Moscow, 1975, pp. 166 and 168. 1974: Petrov and Molodtsova, p. 156, from transportation chapter by S. L. Shiryayev. 1976: I. Korkunov, et al., "China's Economy in 1976," Far Eastern Affairs, No. 2, 1977, pp. 19–24. The Soviets use reported Chinese figures and a sprinkling of U.S. estimates from: Philip W. Vetterling and James J. Wagy, "China: The Transportation Sector," People's Republic of China: An Economic Assessment, Joint Economic Committee of the U.S. Congress, Washington, 1972, p. 178.

E. Measuring China's Economic Performance

Normally, post-1960 Soviet publications have avoided quantitative measurements of China's economic growth. Since 1970 a few sources started publishing some figures for the more important economic indicators and for selective key years. Molodtsova again breaks with tradition, however, and includes a 25-page chapter entitled "Aggregate Social Product and National Income of the PRC and Methods of Calculation." In this chapter she provides some interpretations of available Chinese data and discusses, in some detail, various Western (including Japanese) estimates of China's economic growth. Tables 7, 8, and 9 present some of the statistical highlights of this analysis.

TABLE 7.—CHINA'S GROSS NATIONAL PRODUCT: 2 SOVIET ESTIMATES

[In billions of 1957 yuan]

Year	Industry		Agriculture		Total	
	(1)	(2)	(1)	(2)	(1)	(2)
1957	70.4	70	53.7	54.0	124.1	124.0
1958	117.1	112–117	67.1	--------	184.1	--------
1959	163.0	--------	49.0	--------	212.0	--------
1960	193.2	--------	43.0	--------	236.2	--------
1961	110.0	--------	45.0	--------	155.0	--------
1962	89.0	89	48.0	--------	137.0	--------
1963	98.4	--------	50.5	--------	148.9	--------
1964	113.2	--------	53.8	--------	167.0	--------
1965	127.9	--------	55.5	--------	183.4	--------
1966	153.0	135	60.0	55.0	213.5	190.0
1967	130.5	110	65.0	--------	195.5	--------
1968	151.0	--------	62.8	--------	213.8	--------
1969	193.3	135	65.5	--------	258.8	--------
1970	233.9	--------	72.1	--------	306.0	--------
1971	268.1	160	74.9	--------	343.0	--------
1972	289.6	173	73.3	64.5	362.9	237.5
1973	315.6	187	78.7	68.4	394.3	255.4
1974	328.3	196	81.1	--------	409.4	--------
1975	--------	215	--------	--------	--------	--------
1976	--------	221	--------	--------	--------	--------

Sources: Cols. 1: Petrov and Molodtsova. Industry from p. 61, agriculture from p. 72, total from p. 83. Cols. 2: Usual Soviet estimates. For the years 1957–73 from "Kitaystakya Narodnaya Respublika: politicheskoye i ekonomicheskoye razvitiye"; 1957, 1966, 1972 and 1973 from p. 125, while the rest of the figures for industry from p. 134. The years 1974 and 1975 from E. Konovalov et al., "China in 1971–75: Economics and Culture," Far Eastern Affairs, No. 2, 1976, p. 26. The 1976 figure is from I. Korkunov, et al., "China's Economy in 1976," Far Eastern Affairs, No. 2, 1977, p. 14.

TABLE 8.—COMPARISON OF SOVIET AND U.S. INDEXES OF CHINA'S PRODUCTION

[1957=100]

Year	Industrial production		Agricultural production	
	(1)	(2)	(1)	(2)
1957	100	100	100	100
1958	166	142	125	108
1959	232	173	91	83
1960	274	181	80	78
1961	156	105	84	77
1962	126	111	89	92
1963	140	134	94	96
1964	161	161	100	106
1965	182	199	103	114
1966	218	232	112	116
1967	185	202	121	123
1968	214	221	117	116
1969	275	266	122	118
1970	332	316	134	129
1971	381	349	140	134
1972	411	385	137	130
1973	448	436	147	138
1974	466	455	151	143

Sources: Cols. 1: Soviet estimates from Petrov and Molodtsova. Index of industrial production calculated from table 7; identical figures, but with a few of the years missing can be found on p. 71, table 6, col. 1; index of agricultural production from p. 72. Cols. 2: U.S. estimates from Central Intelligence Agency, National Foreign Assessment Center, "China: Economic Indicators," October 1977 (ER77-10508), p. 3.

TABLE 9.—DISTRIBUTION OF NATIONAL INCOME

[Estimates in current prices]

Indicators	Units	1957	1965	1970	1974
Population	Millions	632.2	705.0	776.9	836.0
National income	Billion yuan	95.0	105.9	156.0	194.0
Per capita national income	Yuan per person	150.3	105.2	200.8	232.1
Consumption	Percent	79.0	70.0	65.0	65.0
Accumulation	do	21.0	30.0	35.0	35.0
Consumption	Billion yuan	75.1	74.1	101.4	126.1
Including personal consumption of population	do	71.3	66.7	86.2	100.9
Personal consumption of populaton as proportion of consumption.	Percent	95.0	90.0	85.0	80.0
Per capita personal consumption	Yuan per person	112.7	94.6	110.9	120.6
Accumulation	Billion yuan	19.95	31.8	54.6	67.9
Capital investment in national economy	do	13.83	22.2	32.8	40.7
Capital investment as proportion of accumulation	Percent	69.3	70.0	60.0	60.0

Source: Petrov and Molodtsova, p. 84. With the exception of the 1957 figures for the proportion of accumulation and capital investment in the national economy, the figures are estimated by Molodtsova.

Table 7 shows the value of industrial, agricultural and total production in billions of 1957 yuan. The second columns under each heading include the figures one is most likely to find in post-1970 Soviet publications; they are significantly lower than any comparable Western estimates. Molodtsova's figures are in the first columns under each of the headings. She makes a drastic upward revision of industrial production, essentially by only slightly adjusting the official Chinese series, as presented by the "Englishman" R. M. Field in *China: A Reassessment of the Economy* (Washington, 1975). It is interesting to note that until 1968 she lowered the official figures slightly, but from 1968 to 1972, probably because of the assumption that Chinese data exclude certain military production, Molodtsova increased the "official series" by 4 to 11 billion yuan for each of the 5 years. The adjustments made by Molodtsova in the value of agricultural production are small—reflecting how little room there is to maneuver in that sector. Especially revealing in the comparison of Soviet and United States indexes of China's industrial production (table 8). Despite reasonable agreement for the end date, there are some clear evidences in the figures of differing perceptions of China's economic performance during specific periods.

F. A Few Comments

Soviet sinologists responsible for evaluating China's economy face a serious dilemma. On the one hand, they are required to emphasize the negative aspects of Mao's wrongheaded (and wronglegged) developmental policies, and point to the deficiencies and problems which they identify throughout the economy. This they do well. On the other hand, these same specialists must explain the Soviet image of China as a strong military power which ostensibly constitutes a serious threat to the motherland and thereby justify maintaining over one-half million Soviet troops along China's border. This they don't seem to do as well.

We tend to look at China's development in terms of cycles that are imposed by shifts in politics and leadership. The Soviets, who maintain that China's "wavelike development" reflects Mao's economic principles, will take 10- or 15-year periods (1965–75, 1960–75, or 1955–65) and give an average annual growth rate of industrial production, gross national product, or whatever, for that timespan. In this way they average out China's good years with her worst years and thereby give no recognition to what China's economy is capable of doing during "normal" periods. The economists know better, but perhaps the Soviet readers do not.

Another method used to downgrade China's economic production is to follow any growth in output with a per capita index, which immediately places China near the bottom of the world's economic totem pole. Per capita statistics are, of course, very valid and useful measures, but it is the compulsion to use these figures as a balance to achievement that so obviously reflect Soviet politics or "peeve." How does this effort to minimize Chinese capabilities square with Soviet concern over the China threat?

The Russians would do well to "hear" China less pedantically. There are many examples of Chinese statements that must be taken with a grain of salt; the Soviets choose to take them striaght. For instance, when the Chinese say they will catch up with the advanced countries of the world by the year 2000, it is merely rhetoric. They know, and we know, that unless the advanced countries stand still this is impossible, although the statement itself may have the internal value of stimulating production and enthusiasm among the people. Such a proclamation has much in common with the Chinese toast "may you live 10,000 years." Some Soviet authors however, snatch at it straight-faced, and spend pages in proving that to accomplish this the Chinese economy would have to grow at "*x*" rate and that because of "*y*" factors the goal cannot possibly be achieved.

This literal interpretation of Chinese verbosity is an important factor in the Sino-Soviet dispute. When the Chinese say, in so many words, that they will destroy the Soviet Union, it is nothing more than bravado for internal and world consumption. They have neither the intent (opinion) nor the capability (fact) to do so.

VI. INTERPRETIVE INQUIRY INTO THE STATE OF SOVIET SINOLOGY

After several months of cohabitation with Soviet writings about the People's Republic of China, the researcher is a little better informed, a little more confused, and with many impressions of varying degrees of importance and, no doubt, validity. Reluctantly, one must admit that under the best of circumstances China-watching is a subjective occupation; watching the Soviets watch China can only add another layer of subjectivity to the exercise. What follows, then, are personal convictions and impressions which naturally do not apply to all Soviet research and all Soviet sinologists, and which are essentially (but not entirely) based on readings in the field of economics. If I am unfair in my evaluations or too severe in my criticisms, I am sorry. I would like to assure my Soviet collegaues—with whom I share many of the daily problems associated with studying contemporary China—that I respect their competence and that my comments should not be taken personally. They must understand that studying Soviet sinology from the United States is not much different than studying China's economy from the Soviet Union—we all have data problems.

A. Politics and Sinology

The intrusion of politics into the social sciences is a well-known characteristic of all socialist nations. Within the present context, the question is to what extent political considerations dictate the content and the conclusions of the research on China. The answer was clear in the 1950's, when Soviet publications uncritically presented the claims and statistics of their Chinese comrades; it was also clear in the 1960's, when polemics overwhelmed all writings on China; the response is less clear for the 1970's, and especially the mid-1970's.

Soviet sinologists visiting the United States become indignant if anyone even suggests that, because there is little if any disagreement in how they perceive China, they are not completely free to state the impartial conclusions of their research. They maintain that there is no consensus in the Soviet Union about China and that scholars are free to express their views either in writing or orally ("we have heated arguments"). Why then such congruency in all Soviet publications? Because, they say, the course of China's political and economic development, makes it intellectually impossible for anyone to disagree with the basic criticisms. How can anyone argue that China is not a militarized society, for example; or defend the Great Leap and the Cultural Revolution; or say that the emphasis on small-scale rural industries is an efficient means of economic development. To further counteract the accusations of political prejudice, they turn the argument around and accuse the China-watchers in the United States of gullibility in accepting China's claims and in seeking (and often finding) rationale for some of Mao's disruptive principles and programs. They say that to the Americans "Peking looks like Gogol's lady—'pleasing in every respect.'" In other words, Soviet sinologists are just as vehement in defending their objectivity and in denying any undue political influences or pressures, as specialists in the West are, in denying any personal biases. As one American observer (who, I hope, will forgive me for forgetting his name) pointed out in looking at the similarities between the U.S. analysis of the Vietnam situation and Soviet analysis of the Chinese situation: myopia knows no international boundaries.

And yet, there seems to be little doubt that some of the myopia is prescribed, especially at the Institute of the Far East. Apparently it is generally known in the Soviet Union, that the price an academician pays for working in this Institute is a curtailment in scholarly freedom. This, perhaps, explains why the first significant revision of estimates of China's economic performance came from Molodtsova, a member of an institute which must tolerate greater independence. The problem is not limited to the Institute of the Far East, of course. A casual perusal of other scholarly publications and especially of the Soviet daily press, would quickly prove that only the most naive could accept the contention that such a sensitive discipline as Soviet sinology is free from political meddling. To add authority to propaganda about the perpetual "acute crisis" in China and the miseries of oppressed Chinese people, Soviet newspapers use innumerable quotations from established academics. Even so, it would be prudent to make a distinction between selected statements for public consumption and the serious and scholarly work produced by Soviet sinologists. If we limit our discussion to bona fide research, it would seem that what from our perspective may appear to be clear-cut biases and distortions, could be sincere evaluations, when strained from the rhetoric and viewed from the Soviet perspective. In addition to arriving at this conclusion from face-to-face discussions with Soviet sinologists, two other reasons can be suggested—one an aspect of practicality, the other of emotion.

By its own admission, the Soviet Union does not have an excess of China scholars. Common sense (and the militiaman at the entrance of the Institute of the Far East) therefore tells us that Moscow's intelligence establishment cannot afford to bypass the resource represented by academic China specialists. To support the requirements of Soviet policy makers, academicians produce not only classified reports ("of course not everything we write is published"), but unclassified publications for internal use and in limited editions (less than 1000 copies). If one issue of such a publication (Far Eastern Institute's *Informatsionnyy Byulleten'*) is representative, then some of the most solid Soviet research on China is available only in this format. It should also be noted that the amount of classified information which may or may not be available to the sinologists at the Academy of Sciences institutes is almost incidental, because even the best intelligence service cannot manufacture data that probably does not exist even in Peking. What is suggested, therefore, is that qualitative differences notwithstanding the basic evaluations made by scholars are the same, whether they appear in open publications or only in government documents. We see only a small part of the research which is being done on China, but at the same time it is not likely that the Soviets "keep two sets of books."

There is another reason (a personal conviction) why interpretations of the China scene by Soviet academicians may appear to be more biased than they are. Emotions are a key factor in the Sino-Soviet schism and emotional factors evolving from a variety of national, personal, political, and educational experiences which create public consensus about China among the Russian people, also affect the thinking of the Soviet leadership and even that of the Soviet scholar.

All too often the analysis of the relations between the People's Republic of China and the Soviet Union begin and end with ideological differences and problems relating to their national security—to power politics. Actually, the basic reasons for the continuing tensions between the two countries may well lie in much more human considerations and emotions. Nations tend to interact in ways that are very similar to interactions between individuals. Up to a point actions and reactions are controlled by intellect (national interest), but once relations develop beyond the casual stage, emotions (national image) tend to play a much more important role in decisionmaking. The rift between the People's Republic of China and the Soviet Union is a perfect case in point.

For 50 years the Soviet Union was the undisputed leader of the Socialist camp and there was no thought on the part of the Soviet leadership that China, emerging as she did from the lowest depths of undevelopment, would or could ever pose a challenge to this position. As we know, however, the challenge to Soviet preeminence did develop; it has been manifested in many different ways and it has been accelerating over the years. Perhaps the first challenge came after Stalin's death when, in China's view, Mao Tse-tung automatically became the foremost living Communist leader and thinker—a notion that the Russians (with their condescending attitude toward the Chinese) could not accept. Russian leaders still subscribe to the theory that the international Communist movement must have just one capital—Moscow—and they will not accept a "divided Rome," so that the wide split that developed between the Moscow and Peking factions of many Communist parties around the world has been most disturbing to them. The struggle for prestige and influence and for supreme authority over the international movement is very real, but much of it can be reduced to a very simple emotion—jealousy.

Closely related to jealousy is the bitter competition that is taking place in international relations. As China strengthened her position and gained confidence, she began to challenge the Soviet Union in ways that often caused Moscow to lose face and prestige and created between the two nations an emotionally contentious relationship. This has been most clearly evident vis-a-vis Third World countries where Soviet economic assistance (technical know-how) vies with the Chinese ideology and theories of development that are so appealing to many of the poorer nations. The Soviets deeply resent China's "crude attempt to pose as champion of small and medium countries." Competitive relations with the United States and Japan have been receiving considerable publicity over the past years and have evoked strong feelings of suspicion between the two countries. Rivalry constantly surfaces in the United Nations, where each of the two members of the Security Council bitterly compete for leadership and recognition and where China has opposed the Soviet Union on many important issues such as arms limitation, the convocation of a disarmament conference, nuclear testing, and so forth.

Nations are notoriously thinskinned, and the Soviet Union is no exception. Whereas one nation usually avoids publicly embarrassing another, the Chinese have taken every opportunity to stick pins into the Soviet underbelly by bringing up to international view events and conditions that the Russians would rather have the world forget. There are many examples of how the Chinese twit the "new tsars," as they like to refer to their former allies. For instance, they constantly remind people of "Soviet imperialism in Czechoslovakia" and they like to point to the "colonial economics" that the "savage international exploiters" maintain with East European countries. These and other charges would be less painful and much easier to ignore or parry if they were brought by a capitalist adversary, but they are especially uncomfortable when made by another socialist state. Furthermore, obvious lies don't hurt as much as half-truths and there is enough substance in most of China's abrasive charges to hurt Moscow's pride and international position and thus cause considerable embarrassment.

There is little doubt that disappointment is another emotion experienced by the Russian leaders. They are "hurt" because China shows no gratitude for the extraordinary economic assistance that was provided by the U.S.S.R. in the 1950's; she no longer even recognizes such aid. Whereas Moscow had hoped that eventually China would become an Asian satellite—a subordinate ally—similar to the nations of East Europe, it is instead faced with a heretic who, the Russians are convinced, is bent on undermining socialist hegemony. It matters little whether or not the original expectations were realistic—the disillusion is real.

Prejudice at the international level is at least as difficult to overcome as it is domestically and at both levels it tends to intensity with diminished contacts. Racial prejudice against the Chinese by the Russian people has a long history, and the short period of cooperation between the two nations is perhaps more surprising than the present antagonism. Fed by ignorance, suspicion, fear, and the memory of the Mongol invasion and the Tartar yoke, the mentality of the Russians toward the "gook" Chinese *(khod'ka)* completely ignores China's rich cultural heritage. There is no reason to assume that the Kremlin's present leaders are exempt from prejudice, even if they are not quite as obvious about it as Khrushchev once was. The Chinese themselves, incidentally, use race as a factor in their competition for the support of the Third World by claiming that the U.S.S.R. is not an Asian country—although two-thirds of it is in Asia—and is therefore disqualified for leadership not only of Asian countries but of African nations as well.

These familiar yet somewhat abstract human emotions bolster each other to create a very real fear on the part of the Government and the people of the Soviet Union—a fear which, in informal conversations, the Russians do not hesitate to express. The "yellow peril," which is now generally accepted as a myth by other nations is still of very real concern to the Russians as they think of over 900 million Chinese "pushing" against their 4,000 mile border. The fear has been further intensified by the Soviet conviction—especially since the Cultural Revolution—that the Chinese leadership, with its nuclear capability to seriously damage many large Russian cities, is not altogether rational, either in thought or in action.

To summarize, then, it is only within the emotional atmosphere created by fear, suspicion and antagonism—constantly fanned by Chinese abusive and exaggerated propaganda—that the issues of ideology and national security become so overwhelming. Since neither country has anything to gain from open hostility over border disputes, Third World issues, divergent policies, and strategies in the United Nations and other differences, no single issue is so serious that it could not be resolved if the emotional factors would somehow vanish.

All too often, however, just as in interpersonal relations, emotions between nations tend to snowball—as history has so well documented. Even statements that might be considered innocuous under different circumstances, take on an evil and ominous tone in the charged atmosphere that exists between China and the Soviet Union. Normally rhetoric reflects relations between two countries. However, it is not too far fetched to suggest that over the past dozen years it has been rhetoric—especially by Peking—which has dictated the nature of relations between the U.S.S.R. and China.

In the Soviet Union there seems to be almost complete congruence between official, academic, and public distrust, dislike, and fear of China—not only of Mao and the Peking leadership, but—unofficially and covertly—of the Chinese people. That is why it is so important to view present-day Soviet scholarship on China within the context of the emotionally charged relations between the two countries. That is why Soviet research on China can be both biased and sincere. That is why there is some question as to whether a Soviet sinologist can be completely objective anymore than a Jewish social scientist can be completely impartial in his research on Hitler's Germany.

B. Strengths and Weaknesses of Contemporary China Studies

Finally, a few comments about what are perceived to be the strengths and weaknesses of contemporary China studies in the Soviet Union; or, perhaps more accurately, the advantages and disadvantages of viewing China from Moscow versus Washington. Keep in mind, however, that "the perceiver" has never viewed China from Moscow—or viewed Moscow, for that matter.

In their study of present day China, including her economy, Soviet sinologists have several advantages, the most important being that "they were there." For more than 10 years many thousands of Soviet specialists and technicians lived in China and were able to observe the country at close range—as comrades, not as enemies. Hundreds of Soviet China specialists spent time in the country either as visitors or as embassy officials. China has changed since the 1950's, but the opportunity the Soviets had, not only through observation, but through their associations with policymakers, administrators, intellectuals, and workers, was not available to anyone else. This experience of the 1950's—and continued diplomatic presence since then—represents an important advantage in the study of China. Although the Soviets accuse the Chinese of distorting the socialist system of development, it is very helpful to know exactly what is being distorted and how it is being distorted.

The top Soviet research institutions and the most prominent scholars on contemporary China are concentrated essentially in Moscow. Presumably this should make for a better planned and better coordinated program which facilitates meetings, conferences, and the general exchange of views and information. In the United States such cross-pollination may require a major effort and a substantial expense; in Moscow—at least in theory—this can be done more quickly and informally. Whether this is, in fact, the case is debatable however, since the impression one gets from Soviet visitors is that sinologists are highly compartmentalized by disciplines.

The Soviets also have the advantage of Western scholarship on China at their disposal. Anyone struggling with economic estimates can appreciate the value of first reviewing the analyses of others—and whether or not one agrees with them is immaterial. Certainly China watchers in the West have not had the benefit of seeing more than a smattering of Soviet estimates. The Soviets, on the other hand, not only obtain all the relevant foreign publications through normal subscriptions and purchases, but in nations where significant work is done on China, Soviet embassies maintain a China specialist whose primary responsibility is to collect unpublished reports and papers, attend conferences, and in general keep up with the activities of scholars and officials working on China. Since the English language has apparently become a prerequisite for the younger generation of China scholars, U.S. research is carefully studied and frequently cited—albeit usually selecting critical evaluations which seem to support and perhaps add authority to their own judgments. With no intent of reprobation, it is safe to say that the new estimates of China's economic performance by Molodtsova have been greatly influenced by Western scholarship. Surely the Soviets would have no problem in writing a report on "U.S. Perceptions of China's Economic Development"—if only there was more uniformity in these perceptions.

There are, however, inherent weaknesses and important handicaps faced by Soviet sinologists in their analysis of Chinese developments. We have no way of knowing the number of people in the Soviet Union who are working on contemporary China, but it is small in comparison to the United States. An obvious reason, but one that is not generally appreciated, is the problem of language. In the United States the overwhelming majority of university scholars and government researchers working on the People's Republic of China rely on the hundreds of pages per week of translated texts—newspapers, journals, radio broadcasts, and other materials—which are available to individuals interested in the day-to-day developments, in China. Even many scholars of Chinese extraction find it more practical to use translations and only occasionally supplement or cross-check this information by consulting the original texts. In other words, the knowledge of the Chinese language, while highly desirable, is not a prerequisite to the study of contemporary China in the United States. While the Soviet Union does apparently publish Chinese radio broadcasts in Russian and probably translates other selected materials from Chinese, the overall effort does not compare to the extensive translation services available in the United States. This means that every person working on China must have a good grasp of the Chinese language. As admirable as this may be, the obstacle of language limits tremendously the number of people who, in addition to getting a higher degree in, for example, economics, would be willing to devote years of additional study to attain a reading fluency of Chinese. In addition to postponing their career for several years, the necessity of analyzing materials in the Chinese language inevitably slows down the rate of progress of any research.[11] Related to the question of language, the Soviet Union does not have the tremendous resource represented by the many hundreds of American scholars and translators of Chinese extraction, who not only have a native language fluency, but also can provide valuable perspective on many of Peking's policies and programs.

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[11] Although there does not seem to be a subscription record in Washington, I was told that the Institute of the Far East receives one copy of the Foreign Broadcast Information Service Daily Report: "People's Republic of China" and perhaps some other American or British translations. There is a great demand for this document among Soviet China specialists and it takes weeks to route it within the China branch of the Institute. Since all reproductions in the Soviet Union are vigilantly controlled ("must have the signature of the head of the department"?), scholars spend hours transcribing in long-hand passages from these publications. Since there are no restrictions on subscriptions for translations distributed by the National Technical Information Service, would it not be practical for the Soviets to subscribe and teach their Sinologists English—as, it seems, they already do?

Another serious handicap faced by Soviet sinologists relates to the availability of Chinese sources. Every Soviet scholar visiting the United States is overwhelmed by the materials on China available in our academic and governmental institutions and by the elaborate retrieval technology. While Soviet centers have impressive Chinese collections in their own right, and have numerous titles not available in the United States, there is no reason to doubt the sincerity of the amazement of visitors with American collections and facilities. When queried about reasons for this discrepancy, the answers are more or less the same. In the fifties, when the U.S.S.R. and the P.R.C. were friendly, the Soviets obtained much material from China, but apparently there was no directed intensive and systematic collection effort; certainly nothing comparable to the U.S. effort. There seemed to be no reason at that time for anything more than a casual procurement of Chinese publications. They apparently did use some of the Hong Kong booksellers to obtain publications from the Chinese mainland after the 1960 schism, but the U.S.S.R. did not seem to establish a wide-ranging procurement system comparable to that of the United States. Why not? One can only speculate; maybe they could not absorb and process more than they already received; more likely, the Soviets did not believe until the late sixties, that the break between them and Peking was anything but temporary.

Finally, in addition to the already discussed intrusion of politics into research on China, there is a weakness in Soviet sinology which stems from the rigidity of the system under which such research is performed. Highly planned, regulated, and coordinated research may not be appropriate in dealing with contemporary China, or, for that matter, with any other area with inadequate data. In this stifling atmosphere there is little imagination in the work on China, and Soviet researchers find it difficult to go beyond the data—an imperative when working with limited information. Duplicative research may seem wasteful and inefficient, but it is exactly this individuality and "freewheelingness" of American research on China, which eventually produces growth in understanding and sometimes even a modicum of consensus. Neither the Soviet political milieu, nor the Soviet highly structured and orthodox educational system encourages the use of creativity, and even occasional flights of fancy, in a field which has such far-reaching political and international ramifications.

Although the Soviets themselves recongize and even publicly admit some of the problems and weaknesses in their research on the People's Republic of China, they will understandably find much to fault in the above evaluation by an outsider and a foreigner. But it would be misleading to end this discourse on a negative note. It is very important not to loose sight of the great improvement that has taken place in Soviet research on the PRC since the beginning of this decade. Whether this trend is accellerated or retarded will depend entirely on the level of political constraints imposed by the leadership on the academics. Unincumbered by political demands for conformity, free to pursue their research and arrive at independent conclusions, Soviet sinologists should be able to move to the forefront of studies on modern China. If this day every comes, it will behoove Western China-watchers to pay much closer attention to what their Soviet counterparts may start saying and writing about China.

ECONOMIC MODERNIZATION IN POST-MAO CHINA: POLICIES, PROBLEMS, AND PROSPECTS

By Nai-Ruenn Chen

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I. Introduction

The major task facing Chinese leaders in the post-Mao era is to realize China's long-held goal of transforming the country into a "powerful modern socialist state" in the shortest possible time. This goal, however, encompasses two, often competitive, components: economic modernity and socialist transformation. The past 28 years have witnessed recurrent ideological conflicts and policy disputes within the Chinese leadership over the relative weight attached to these two components. The "moderate" group assigns greater priority to economic growth while viewing the attainment of socialist values as a long-range objective. The "radical" faction, on the other hand, advocates the simultaneous achievement of economic development and socialist revolution, and opposes programs and methods that may speed industrialization and modernization but undermine socialism.[1] The debate resumed in the early 1970's, and intensified in late 1975 and the first nine months of 1976, culminating in the downfall of the "gang of four" and the rise of the "moderate" group to the dominant leadership position.

The current leadership under Hua Kuo-feng is committed to accelerating economic growth. The "speed of development" is viewed as not purely an economic question, but a political question of greatest importance.[2] At the National Industrial Conference in May 1977 Hua declared: "In the next 23 years the development of the Chinese economy should and will be faster and better than in the past 28 years." [3] The same theme was repeated in other leaders' speeches, articles, and editorials throughout 1977.[4] This theme constituted the framework of the report Hua delivered on February 26, 1978 to the Fifth National People's Congress (NPC), a report which has become the most important and detailed economic policy document emanating from China in recent years.[5]

An attempt is made in this paper to outline the development program which the current leadership has adopted for achieving accelerated economic growth and to discuss its long- and medium-range goals and their implications for policy formulation. A major portion of the paper is devoted to an analysis of the major economic issues occasioned or accentuated by the newly adopted development program, and discusses policy measures advanced for resolving these issues. To provide insights into these issues and better understand the rationale of new policies, references are frequently made to the debate over the past few years. The main emphasis, however, is on an analysis of the pragmatic perceptions of the post-Mao leadership from the vantage point of 1977 and early 1978. The final section is devoted to an assessment of the constraints on China's development program and to a projection to the end of the century of China's probable economic position relative to major industrial powers.

II. A THREE-STAGE DEVELOPMENT PROGRAM

1. The Background

To achieve accelerated economic growth, the post-Mao leadership has revitalized the two-stage development program previously enunciated by the late Chou En-lai and has reformulated it into a three-stage program. In his report to the fourth NPC in January 1975, Chou outlined a two-stage modernization scheme:

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[1] In this paper the term "moderate" is used interchangeably with "pragmatist", and "radical", with "dogmatist" or the "gang of four". The two groupings represent clearly identifiable political factions in China, formed between the end of the Cultural Revolution and the arrest of the "gang of four" in October 1976. These factions advocated distinctive economic platforms embracing, in addition to the basic issue of economic growth versus socialism, a wide range of other issues to be brought out in the following sections. It may be noted here that while Chinese writers, both radical and moderate, like to depict policy options as diametrical opposites, some of the policy differences are differences in degree or emphasis, not contradictory alternatives. In our discussion of the radical and moderate viewpoints, the present tense is frequently used because although the radical group has largely fallen silent its perception remains germane to the policy debate in China.

[2] Commentator, "The question of Speed Is a Political Question," People's Daily, October 26, 1977, p. 1.

[3] "Comrade Hua Kuo-feng's Speech at the National Conference on Industry Learning from Teaching (May 9, 1977)," People's Daily, May 13, 1977, pp. 1-3; quotation on p. 3.

[4] See, e.g., Yu Chiu-li, "The Conditions of China's National Economic Development," People's Daily, October 25, 1977.

[5] Hua Kuo-feng's Report on the Work of the Government Delivered at the First Session of the Fifth National People's Congress (February 26, 1978), in People's Daily, March 9, 1978, pp. 1-5; hereafter referred to as "Hua's Report to the Fifth NPC."

> The first stage is to build an independent and relatively comprehensive industrial and economic system * * * before 1980; the second stage is to accomplish the comprehensive modernization of agriculture, industry, national defense, and science and technology before the end of the century, so that our national economy will be advancing in the front ranks of the world.[6]

The visualization of a two-stage development was not new; it was first mentioned, also by Chou, in his work report to the third NPC in December 1964.[7] At that time, the Chinese economy had largely recovered from the 3-year depression following the Great Leap. Chou was hopeful that after further improvements in 1965, the economy should be ready for a long-term drive toward modernization beginning from 1966, the first year of the third five-year plan. But the modernization program was rarely mentioned again in the Chinese press. It seems that the Chinese leadership was divided on this issue. The differences probably did not revolve so much around the ultimate goal of economic modernization as around the methods by which it might be achieved.

The main opposition could have come from the late Mao Tse-tung.[8] At the time of the third NPC, the governmental and party apparatuses were firmly in the hands of Liu Shoa-chi and Teng Hsiao-ping, later labeled as the first and second "capitalist roaders," respectively, during the Cultural Revolution. Mao was seriously concerned that the policy measures formulated under the Liu-Teng sponsorship to implement the modernization program would very well lead China to "revisionism."

In any case, the modernization program was shelved during the Cultural Revolution. After a lapse of 10 years, Chou once again presented it to the Fourth NPC for at least two reasons. The Chinese economy, recovering from the tumultuous years of the Cultural Revolution, had made good headway in the early 1970's, and Chou apparently thought that the time was ripe for China to make another attempt to embark upon the modernization drive. Further, suffering from terminal cancer, he wanted to lay down the groundwork for the drive befor his death. Teng Hsiao-ping was entrusted with the responsibility for drawing up plans to implement the modernization program.[9]

During the summer of 1975, a draft uotline of a 10-year economic plan (1976–85) was prepared. The outline was discussed and approved by the Politburo.[10] At the same time, three policy documents were drafted under Teng's direction: 1. "Certain Problems in Accelerating

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[6] Peking Review, No. 4, Jan. 24, 1975, p. 23.

[7] Ibid. In the published version of Chou's 1964 report only a brief reference was made to the desirability of modernizing agriculture, industry, national defense, and science and technology "within a not too long historical period." No mention was made of the two-stage development scheme, nor was the end-of-the-century objective specified. See a summary of Chou En-lai's report on the work of the Government to the Third National People's Congress in Red Flag, No. 1, 1965.

[8] In his 1975 report, Chou En-lai pointed out that the visualization of a two-stage development was made "on Chairman Mao's instructions." Indeed, in the 1950's, Mao already frequently envisaged in his writings a modernized China within a few decades. For example, in his famous 1957 speech on constradiction, Mao spoke of building China into "a socialist country with modern industry, agriculture, and science and culture." ("Mao Tse-tung's Selected Works," vol. V, 1977 (Chinese edition), p. 366). Earlier, he talked about overtaking the United States in 50 to 60 years. At the same time, however, Mao was decply committed to his ideological goals of socialist revolution. In his view, economic growth and modernization should not be attained at the expense of socialist values. The view became stronger in the 1960's than in the 1950's.

[9] Among the reasons why Chou chose Teng as his successor probably were not only Teng's strong administrative ability and pragmatic economic philosophy but also the same commitment which Teng shared with Chou toward China's economic modernization. Soon after the conclusion of the Fourth National People's Congress, Teng began to take steps to formulate concrete measures for the two-stage development program. See Kung Hsiao-wen, Teng Hsiao-ping and the 20 Articles," Study and Criticism (Hsueh-hsi yu p'i i-p'an), No. 6, June 14, 1976.

[10] Hua's report to the Fifth NPC.

Industrial Development"; 2. "Outline Report on the Work of the Academy of Sciences"; and 3. "On the General Program for All Works of the Whole Party and the Whole Nation".[11]

The first two documents, hereafter referred to as the "20 Articles" and the "Outline Report," respectively, represented Teng's and his followers' policy proposals to achieve economic modernization. Called the "three great poisonous weeds," these documents were severely criticized by the "radicals" in their campaign to oust Teng whom now was termed an "unrepentant capitalist roader." Even after Teng was removed from the Vice Premiership following the Tien-an-men Incident in April 1976, the "radicals" kept up a steady attack on Teng's economic views throughout the summer in an apparent effort to throw out the elements of the Teng policy which the Government under Premier Hua Kuo-feng might choose to carry on. For months, political uncertainties plagued China's policymakers and immobilized economic planners. The drive toward economic modernization came to a halt. At the time of Mao's death (September 1976), it would appear that the modernization program which Chou twice presented to the country would again be aborted.

Immediately after the purge of the "gang of four" in October 1976, Chou's year 2000 objective—the so-called four-modernizations program—was emphatically restated by Chinese leaders, including the Party Chairman and Premier, Hua, on numerous occasions.[12] Soon, Teng's economic policy proposals were widely praised in the press, to be followed by his return to the Vice Premiership in July 1977. The year 2000 objective was formally introduced into the Constitution of the Chinese Communist Party adopted by the 11th Party Congress in August 1977, and then also into the Constitution of the People's Republic of China adopted by the Fifth NPC in March 1978.

The outline of the 10-year economic plan (1976–85), which was drafted in the summer of 1975, has been revised and approved by the Fifth NPC.[13] The State Planning Commission (SPC) is in the process of translating policy goals into operational plans. The balance of the century has been divided into three stages instead of two stages in the original blueprint sketched by Chou. The first stage covers 1978–80, the last 3 years of the Fifth Five-Year Plan; the second stage coincides with the Sixth Five-Year Plan (1981–85); and the third stage is a 15-year period ending in 2000. The available information seems to indicate that a detailed plan formulation for the first stage has largely been completed, and that the operational plan for the second stage is under preparation. For the third stage, however, only a long-range perspective plan is being conceived, and details are not likely to be worked out until the early 1980's. In the past year, Chinese planning workers are said to "have filled out tens of thousands of figures" and "have drawn tens of thousands of diagrams." [14] Yet except for a few target figures mentioned by Hua in his report to the Fifth NPC, no detailed information has been released. The remainder of this section is thus confined to an analysis of the broad goals for each stage as articulated in Chinese articles and the types of policies that these goals would entail.

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[11] For a report of the contents of these three documents, see the article by Ch'i Hsin in "The Seventies" (Ch'i-shih nien-tai), March 1977, pp. 9–12.

[12] The first such signal came on Oct. 25, 1976, 2 weeks after the arrest of the "gang of four", in the joint editorial of the People's Daily, Red Flag, and the Liberation Army Daily. See the People's Daily, Oct. 25, 1976, pp. 1 and 4.

[13] People's Daily, Mar. 7, 1978.

[14] People's Daily, Jan. 3, 1978, p. 2.

2. Stage I: 1978–80

The goal set for 1980, as indicated in Chou's 1975 report, to build an "independent and relatively comprehensive industrial and economic system," has been a guiding principle of the People's Republic since its inception.[15] Having known the pain of dependence from a century of foreign presence in China, the Chinese Communist leaders have come to the belief that political independence cannot be achieved without economic independence, which in turn hinges on the establishment of an economic system capable of creating a domestic supply sufficient to meet increases in demand generated by economic growth. This belief was reinforced by the Western trade embargo instituted in the early 1950's and the withdrawal of Soviet economic assistance nearly a decade later. It is not surprising, therefore, to find China very much opposed to the concept of "international division of labor" or that of "integration with the world economy." [16]

The pursuit of an "independent and comprehensive" industrial system requires the creation of a domestic production capacity in the entire range of industries. To achieve this, China must have access to raw materials. Fortunately, the country is endowed with varied and reasonably abundant natural resources.[17] The large resource base, widely distributed throughout the country, makes regional specialization and an internal division of labor possible. Moreover, the large size of the Chinese population provides a market that permits many economies of scale. For these reasons, the cost of not pursuing international specialization should be less pronounced in China than in many a smaller country. But the Chinese have never aimed at building an autarkic system. They are fully aware of the economic benefits that can be gained through foreign trade.[18]

In the past 28 years, China has made considerable progress in creating an "independent and comprehensive" industrial base. In the producer goods sector, high rates of self-dependency have been achieved for a number of key products,[19] but China still has gross deficiencies in, or does not have the capacity or resources for the production of, a wide range of products.

Another goal set for 1980, which was not explicitly mentioned in Chou's 1975 report, relates to agricultural mechanization. In a preponderantly agrarian and labor-abundant economy such as China's, industrial growth cannot be sustained without substantial development of the agricultural sector. Agriculture provides food for the industrial labor force, exports to exchange for capital goods, labor and capital for industry, raw materials for consumer goods production, and markets for industrial products. The Chinese learned important lessons from the hard experience of the 1950's when the relatively slow pace of advance in agriculture hampered and retarded industrial growth. In spite of the high priority assigned to agriculture and those industries producing inputs to it, agriculture remains the greatest bottleneck in the Chinese economy. The success of China's economic modernization, therefore, will depend critically on its ability to sustain steady increases in farm output.

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[15] Before the establishment of the People's Republic, Mao already spoke of "solving the problem of building an independent and comprehensive industrial system." See his "Report to the Secondary Plenary Session of the Seventh Central Committee of the Chinese Communist Party," in Mao Tse-tung's selected Works, vol. IV (Chinese edition), p. 1424.

[16] See, for example, Mao Wen, "Refute the Soviet Revisionist Theory of 'International Geographic Division of Labor'," People's Daily, Dec. 12, 1976, p. 6.

[17] China now has various quantities of verified reserves of 132 minerals, 17 of which, including coal, iron, copper, and crude oil, rank among the top in the world. (People's Daily, July 15, 1977, p. 1.)

[18] The Chinese realize, in particular, that there are certain resources which China lacks and, in the pursuit of a comprehensive industrial system, which should be secured through trade. See Tsiang Cheng-yun, "On Self-Reliance," Economic Research (Chin-chih yen-chiu), No. 1, 1965, pp. 1–9.

[19] Dernberger's study suggests that the rate of self-dependency in machinery and equipment rose from about 75 percent in the 1950's to more than 90 percent in the 1970's. (See Robert F. Dernberger, "China's Economic Future," in "China's Future: Foreign Policy and Economic Development in the Post-Mao Era," New York, 1977. The rate of self-dependency in crude oil must have improved dramatically as China has changed from a net importer to a net exporter. Also, the ratio of imports to total supply of chemical fertilizers has declined steadily in the last decade. (See National Foreign Assessment Center, "China: Economic Indicators," Washington, D.C., October 1977, p. 12.)

To upgrade agricultural productivity the Chinese seem to have designed a long-range comprehensive program involving farm mechanization, farmland capital construction, water control, chemical fertilizer, improved seeds, and "scientific farming." In the present stage of development, special emphasis is being placed on mechanization. The guiding principle is one of Mao's dictums, "The fundamental way out for agriculture lies in mechanization." At the First National Agricultural Conference in October 1975, Hua Kuo-feng called for farm mechanization to be "basically achieved" by 1980.[20] The Central Committee of the Chinese Communist Party issued a document at the beginning of 1977 to renew Hua's call. In January 1978 the Third National Conference on Agricultural Mechanization was convened in Peking reportedly to review the implementation of that document, exchange experiences, and formulate measures for accelerating agricultural mechanization in the next 3 years.[21] The conference made a number of major policy decisions and specified several targets to be achieved by 1980.[22]

The main contribution of mechanization to the growth of agricultural productivity seems to lie not in its ability to raise directly yields per unit of land, but rather in its capacity to substitute for labor. There are indications that rural labor in China is in short supply because it is being increasingly absorbed into the rapidly expanding rural industries and, more importantly, because more and more labor is being applied to a given unit of land as the intensity of land use is greatly stepped up.[23] At the same time, a large-scale farmland capital construction movement is under way to reclaim and terrace the land.

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[20] To "basically achieve" farm mechanization means that roughly 70 percent of farm production and processing operations, encompassing not only transplanting, harvesting, threshing, and grain milling but also a wide range of agriculture-related activities such as land improvement, water control, forestry, animal husbandry, fisheries, and transportation are to be mechanized. For a discussion of the farm mechanization program, see Scott S. Hallford, "Mechanization in the PRC", Current Scene, vol. XIV, No. 5, May 1976.

[21] People's Daily, Jan. 5, 1978, pp. 1–2. The First and Second National Conferences on Agricultural Mechanization were held, respectively, in 1966 and 1971.

[22] For these decisions and planned targets, see a major policy speech delivered by Vice Premier Yu Chiu-li at the Third National Conference on Agricultural Mechanization on Jan. 26, 1978 (People's Daily, Jan. 29, 1978, pp. 1–3). Some of these decisions are alluded to in the following section on planning and management. Among the major targets for the percentage increase of farm machines by 1980 over the present level are: 70 percent for large- and medium-size tractors; 110 percent for machine-drawn farm implements; 36 percent for hand-guided tractors; and 32 percent for drainage and irrigation equipment. In addition, chemical fertilizer output is to be increased by 58 percent in the next 3 years.

[23] In recent years the intensity of land use has been increased through the extension of double and triple cropping and through more interplanting and transplanting of crops. Designed to raise unit area yields, these measures absorbed a great deal of labor.

The movement involves masses of labor, and will make farm mechanization all the more important.[24]

3. Stage II: 1981–85

The Sixth 5-Year Plan is said to aim at a greater expansion of both agricultural and industrial bases so that by the end of the plan period "the present backward conditions of the Chinese economy will be changed most profoundly." [25] By 1985, 85 percent of all major processes of farmwork will be mechanized and for each member of the rural population there will be one *mou* of farmland "with guaranteed stable high yields irrespective of drought or water-logging." [26] In each year the value of agricultural output is to increase by 4 to 5 percent, and the country is to produce 400 million metric tons of grain by 1985. In addition, all state farms and 12 so-called large commodity grain bases are to "achieve a twofold or threefold increase in marketable grain" between now and 1985.[27]

In industry, the establishment of a "comprehensive" system is to be pushed further. The target for industrial growth is set at an annual rate of over 10 percent. In the next 8 years "the increase in the output of major industrial products will far exceed that in the past 28 years * * * and investments budgeted for capital construction will * * * be equivalent to the total for the past 28 years." [28] China plans to "build or complete 120 large-scale projects, including 10 iron and steel complexes, 9 nonferrous metal complexes, 8 coal mines, 10 oil and gas fields, 30 power stations, 6 new trunk railways, and 5 key harbors. The completion of these projects added to the existing industrial foundation will provide China with 14 fairly strong and fairly rationally located industrial bases." [29]

The country is to be divided into six major regions.[30] With the completion of an "independent and fairly comprehensive industrial complex and economic system for the whole country" by the end of the Sixth 5-Year Plan, a regional economic system will in the main have been established in each of the six major regions.[31] Such a system

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[24] The limited supply of cultivated land remains a major constraint on Chinese agricultural growth. In China the greater proportion of cultivable land had long been occupied and tilled, and any remaining area can be opened up only at the cost of considerable investment. As early as 1956, Chou En-lai told an Indian agricultural delegation that high costs limited the scope of land reclamation, The present level of cultivated acreage in China is probably no higher than the 1956–57 level. A recent article by Chen Yun-kuei, the Vice Premier in charge of agricultural planning, seems to indicate that the official thinking may be inclined toward a massive expansion of cultivated acreage through greatly stepping up "farmland capital construction." At the present time the cultivated acreage accounts for slightly over 10 percent of the land area in China. Chen now asks, "Can this be expanded to 20 percent? To 30 percent?" His answer is affirmative, but he maintains, "the heart of the matter is whether you make the effort or not." (See Chen Yun-kuei, "Treat Farmland Capital Construction as a Great Socialist Undertaking," Red Flag, No. 10, 1977, pp. 23–30.) If China is to make an all-out effort to reclaim land, labor requirements will be tremendous, aggravating greatly te already serious problem of rural labor shortages.

[25] Commentator, "Struggle for the Development of the National Economy at a High Speed," Red Flag, No. 1, Jan. 5, 1987, pp. 11–15; and Wu Lu, "Welcome the New Leap Forward," People's Daily, Jan. 3, 1978, p. 2.

[26] Hua's Report to the Fifth NPC.

[27] Ibid.

[28] Ibid.

[29] Ibid.

[30] These six big regions are: Northeast China, North China, East China, Central-South China, Southwest China, and Northwest China. Such a division was first mentioned by Vice Premier Yu Chiu-li, head of the SPC, in a report to the National Industrial Conference in May 1977. (People's Daily, May 8, 1977, p. 3.) An SPC article in the Sept. 12, 1977, People's Daily provides a definition for these regions. Only in January 1978 did the Chinese press begin to mention the establishment of distinctive economic systems in these regions as the major task for the Sixth 5-Year Plan. Regional economic systems were also mentioned by Hua in his Feb. 26, 1978, report to the Fifth NPC.

[31] Hua's Report to the Fifth NPC.

"will achieve a different level of development and * * * will have its own special features, operate independently (and) cooperate with one another." Further, the system will be characterized by "a balanced coordination in the development of agriculture, light industry, and heavy industry."[32]

The division of the country into major regions is not new in China. Prior to 1953 there were six regional governments, but they reflected mainly the location of the areas newly occupied by the principal elements of the People's Liberation Army. In 1956, in his "On the Ten Major Relationships" Mao discussed the advantages and disadvantages of establishing big regions as a way to handle the relations between the central and local authorities.[33] In 1969 there was some discussion of creating "cooperative zones" (hsieh-tso chu) to coordinate industrial production among neighboring provinces.[34] The recent decision to adopt six economic regions seems to have been based on the belief that the establishment of a "relatively independent" economic system in each region, taking into account distinctive regional differences in both resource endowment and the stage of economic progress, would assure better utilization of the existing resources within the region. The decision was probably prompted by the disruptions in economic planning and coordination caused by excessive decentralizations in the last few years. The introduction of an intermediate level of planning between the central and provincial authorities, as will be noted later, reflects the desire on the part of the central economic planners to facilitate centralized control over major resource allocation decisions.

4. Stage III: 1986–2000

The goal for the third stage is to accomplish the "comprehensive" modernization of the Chinese economy and propel it to "the front ranks of the world" by the end of the century. The meaning of "modernization," as used in China, has changed over time. It was originally used to characterize basic changes in institutions, ideas and practices stimulated and inspired by the activities and examples of Western nations during the late nineteenth and early twentieth centuries. Therefore, the terms "modernization" and "westernization" were used synonymously. But much of the Chinese discussion after 1949, particularly in recent years, seems to characterize modernization as a process in which modern science and technology gradually spread to production and defense so that their technical levels may become comparable to those of the advanced countries.

The Chinese concept of modernization and the year 2000 objective were recently clarified by Teng Hsiao-ping when he discussed the modernization of science and technology.

> Our objective in developing science and technology is to approach as far as possible the advanced world level by the end of the twentieth century, catching up with it in a considerable range of studies and surpassing it in certain field.[35]

This interpretation was later extended to other sectors as well in a January 1978 *Red Flag* article:

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[32] SPC, "A Great Guiding Principle of Socialist Construction," People's Daily, Sept. 12, 1977, pp. 1–2; quotation on p. 2.

[33] Mao Tse-tung's Selected Works, Vol. V, p. 276.

[34] The Writing Group of Peking Municipal Revolutionary Committee, "China's Road to Socialist Industrialization," Red Flag, No. 10, Oct. 1969, pp. 22–31.

[35] Teng made this statement to visitrs from the European Organization for Nuclear Research in Sept. 1977, (People's Daily, Sept. 27, 1977, p. 1.) Teng's statement is said to be in accordance with "the greate decision made by Chairman Hua and the Party Central Committee." People's Daily, Oct. 27, p. 2.)

> To enable our national economy to advance in the front ranks of the world, the majority of our production technologies will approach to, and some of them will catch up with or surpass, the level attained by the most developed capitalist country at that time (the year 2000).[36]

More recently, the long-term goal was described by Hua Kuo-feng in similar terms:

> By the end of this century, unit yields of major agricultural products are expected to reach or surpass advanced world levels and the output of major industrial products to approach, equal or outstrip that of the most developed capitalist countries.[37]

This goal would seem most difficult to achieve for agriculture due to China's still very low level of achievement in agricultural science and basic research. For example, the sophistication of Chinese genetic research is thought to be about 25 years behind the West's.[38] The problem is complicated by China's factor endowments and its wide regional variations in climate, soil, water supply, and cropping patterns. Thus scientific findings cannot be universally applied to farming without considerable adaptation to local conditions. But the goal will not be easy for defense and industry to achieve either. In weapons production technology China is probably 15 to 20 years behind the Soviet Union, and even farther behind the United States.[39] Although China has made major efforts in developing the producer goods industry, industrial production technology in most fields still lags 20 to 40 years behind the U.S. level.[40] Since the technology in the advanced countries will continue to make progress, to narrow the gap will require China to greatly accelerate its technological growth to rates considerably higher than those attained by the advanced countries in the future.

5. Implications for Policy Formulation

The major goals of China's long-term development program, as outlined above, call for high rates of capital formation, both physical and human. To create a "comprehensive" industrial economy in the first two stages and establish distinctive economic systems in the six regions in the second stage will involve an expansion of existing facilities and construction of new plants, both of which will require new investment and long gestation periods. Most of these additional and new plant facilities will not start to operate until some time in the second stage, and will begin to have significant impact on economic growth only in the third stage. The process of human capital formation through education and training, which is essential to technological progress, is even slower, and is not likely to emerge as a leading source of China's economic growth until some time in the third stage. An important question thus arises: What is to be the major source of accelerated economic growth in stage I?

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[36] Red Flag, No. 1, Jan. 5, 1978, p. 14.

[37] Hua's Report to the Fifth NPC.

[38] Alva Lewis Erisman, "China: Agriculture in the 1970's," in Joint Economic Committee, China: A Reassessment of the Economy, Washington, D.C., July 1975, pp. 324–349.

[39] Joint Economic Committee, Allocation of Resources in the Soviet Union and China—1977, part I, Washington, D.C., 1977, p. 61.

[40] According to a number of available estimates, the technological level in Chinese industry trails that in American industry by roughly 40 years for motor vehicle production, 25 years for certain steel and machinery plants, 20 years for aero-engine design and production, 15 to 20 years for oilfield operations and equipment and more than 20 years for the electric power industry. (Washington Post, Oct. 23, 1977, pp. 1, 3; Hans Heymann, Jr., "Acquisition and Diffusion of Technology in China," in Joint Economic Committee, China: A Reassessment of the Economy, 1975, pp. 678–729; and William Clarke, "China's Electric Power Industry," in this volume.)

Chinese planners seem to look to improvements in economic efficiency as a main source of economic growth for the next few years.[41] The Chinese economy is at present operating considerably below full efficiency. Elimination or curtailment of various inefficiencies in economic operations could lead to significant increases in output. To the extent that investment in China will have to be financed out of current output and savings, the degree of success the country experiences in coping with the efficiency problem will have a significant bearing on its ability to achieve the rate of capital formation required by the development program. Moreover, once the overwhelming inertia which seems to have frozen the resource allocation patterns in China in the past decade has been overcome, sustained high economic growth over the long run will be considerably facilitated.

III. Economic Planning and Management

In this section we identify some of the most important factors which give rise to inefficiencies in the Chinese economy in five issue areas: (1) material incentives; (2) manpower utilization; (3) industrial management; (4) economic planning; and (5) investment allocation. These areas of concern are interrelated and closely linked to the rate of investment. They were the subject of intense debates before the purge of the "gang of four," and are now the focal points around which new economic measures are being formulated.

1. Material Incentives

To motivate work the Chinese have relied on both ideological and material incentives. While China, perhaps more than any other country, uses ideological appeals designed to bring out a sense of commitment on the part of the work force, material rewards remain the most important form of work incentives. But industrial wages and peasant earnings are kept low so that a substantial portion of the net output can be channeled into investment.

Average industrial wages have improved very little since 1956–57.[42] The level may even have declined because bonuses, which constituted on the average 6 to 8 percent of industrial workers' wages in the 1950's, and overtime pay were almost totally abolished in the latter years of the Cultural Revolution.[43] The virtual standstill in urban per capita consumption gave rise to widespread discontent among industrial workers. There were frequent slowdowns and even strikes. The problem became serious in 1974 when labor unrest in many plants caused production to fall sharply. Plans to raise wages did not materialize that year or in 1975, apparently because of radical opposition.[44] The adverse effect of wage disincentives on production heightened in 1976 in the midst of political uncertainties.

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[41] Hua Kuo-feng in his report to the Fifth NPC stated, "In the next 8 years, and especially in the next 3 years, our existing enterprises must be the foundation for the growth of production."

[42] Prior to the October 1977 raise, the only relatively large increases in industrial wages after the 1956 wage reform took place in 1963. Some minor adjustments were made in 1957, 1959, 1960, 1971, and 1973. (Economic Reporter, No. 40, Oct. 12, 1977, p. 12 and People's Daily, Jan. 2, 1978, p. 1.)

[43] Jan S. Prybyla, "Work Incentives in the People's Republic of China," Review of World Economics, 1976, pp. 767–91. Three separate incentive schemes, based on cash payments and the award of simple consumer items, were reintroduced in a factory in Shenyang of Liaoming Province in August 1975. But they were discontinued the following January. See Peter Weintraub and Ma Chu, "The Wooing of China's Workers," Far Eastern Economic Review, vol. 99, No. 4, Jan. 27, 1978, pp. 46–49.

[44] Peking Review, No. 49, Dec. 2, 1977, pp. 3, 27.

Much of the drag on wage hikes since the cultural revolution seems to have stemmed from both theoretical and practical difficulties. China's payment system, based on the principle of to each according to his work,[45] came under attack from a group of party dogmatists. They oppose differentiated rewards under the current eight-grade wage system which, in their view, still contains the remnant element of bourgeois right and provides the vital economic base for the emergence of a new elite class.[46] Pragmatists, on the other hand, argue that China's current wage system is a product of the old society and cannot be drastically changed within a short period of time. Some of them believe that wage differentials should be gradually narrowed as both productivity and social consciousness grow, while others think that wage differentials will persist for a long time.[47]

The infrequency and small size of wage increases in the past also resulted from economic considerations. An increase in the wage bill would have reduced immediately the fund available for investment, and thus the rate of overall economic growth. It was particularly difficult to raise wages in 1974–76 because the government failed consecutively in those 3 years to meet revenue targets.[48] Further, wage increases would have led to a rise in demand for consumer goods, especially if most of the wage increases went to the low-grade workers who would have higher propensity to consume than high graders.[49] With the increase in consumer goods production hardly keeping pace with the growth of population and export needs, wage hikes would have inevitably created inflationary pressure on the economy.

The Hua government apparently felt that the wage issue should not be further delayed. The decision in the summer of 1977 to give Chinese workers a raise, which was facilitated by an increase in state revenue[50] allowed 64 percent of the nonargricultural workforce to receive some increases, effective October 1, 1977.[51] The amount of the increase in the total wage bill and the number of workers benefited were both the largest in the 28-year history of the People's Republic. An early 1978 report indicates that price stability has been maintained in spite of the expanded purchasing power due to an increase in state commodity purchases, and that labor discipline has improved considerably.[52] As the Chinese econony progresses, future wage increases may be expected to become more frequent than in the past, especially for low-grade workers.[53]

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[45] Article 9 of the Constitution of the People's Republic of China (adopted on Jan. 17, 1975, by the Fourth NPC at its first session) states:

The state applies the socialist principle: "He who does not work neither shall he eat" and from each according to his ability, to each according to his work."

This passage has been retained and became part of article 10 of the new Constitution adopted on Mar. 4, 1978, by the Fifth NPC.

[46] Li Hung-lin, "Is Distribution According to Labor a Socialist or Capitalist Principle?" People's Daily Sept. 27, 1977, p. 3; and Su Shao-chi and Feng Lan-jui, "Refute Yao Wen-yuan's Erroneous Theory tha' Distribution According to Labor Would Give Rise to a Bourgeois Class," People's Daily, Aug. 9, 1977, p.3t

[47] An article in the June 1977 issue of the Nanking University Journal went a step further to state plainly, "Equalitarianism will not work at present, now will it work in the future." See Wu Shan-lin, "We must uphold the Socialist Principle of "From Each According to his Ability, to Each According to His Work," Nanking University Journal No.2, 1977, pp. 43—46, 37.

[48] YuChiu-li, "The Conditions of China's National Economic Development," People's Daily, Oct. 25, 1977, pp. 2, 4; and People's Daily. Jan. 9, 1978, p. 1.

[49] Wage increases in the past frequently took the form of promoting workers in grades 1 and 2 en masse.

[50] Ibid. In the first 9 months of 1977, state revenue rose 7.8 percent.

[51] About 46 percent of the workers and employees received pay raises. The emphasis was on those with many years of working experiences but receiving fairly low pay. Included were industrial workers, workers and employees in trade and other services, teachers, scientific and technical workers, medical personnel, literary and art workers, and government employees. Another 18 percent of the workers and employees were granted pay raises because they had been graded too low for their jobs. Those who received 90 yuan and up were not included. See People's Daily, Jan. 2, 1978, p. 1, and Foreign Broadcast Information Service, Daily Report—People's Republic of China (hereafter abbreviated as FBIS), Nov. 10, 1977, pp. E1–2.

[52] FBIS, Jan. 3, 1978, pp. E 16–17.

It seems that other incentive measures will also be implemented. In his report to the Fifth NPC, Hua stressed his opposition to egalitarianism and the importance of applying the principle of more pay for more work. He stated further that piecework and bonuses should "play a secondary role" in the pay system.[54] Recently, a number of articles have appeared arguing in favor of the bonus and piecework systems. Bonuses and piecework are defended as "a supplementary mechanism for achieving distribution according to labor—making up for the weaknesses in basic forms of labor remuneration." [55] They are considered a "necessary material encouragement," useful in mobilizing the "socialist initiative of the masses," especially in a low-wage situation.[56] Until the Fifth NPC, the leadership had not officially endorsed bonuses and other incentive schemes, probably because of their concern over possible accusations of repudiating an ideology bearing Mao's own stamp of approval. But the economic advantages of using material incentives are so great that China's pragmatic leaders may have felt that the reinstitution of the bonus system and other incentive measures should not be delayed further.

The industrial wage increase will widen the urban-rural income differential, an effect contravening long-held Chinese policy objectives. Thus, measures to improve agricultural income will have to be considered.[57] The bulk of peasant income is derived from work points earned from labor performed for the collectives and based on the amount and types of labor involved. This system, like the industrial wage structure, came under attack from the "radicals" for its inegalitarian tendencies. Payments were disrupted in a number of communes especially in 1976, resulting in a decline in labor productivity and output. Over the past year, the government's effort in this area seems to have focused on the restoration and strengthening of the reward structure based on the principle of "distribution according to labor." [58] Recovery in production has been reported in the press.[59]

Private plots provide an important source of supplementary income for the peasant household.[60] They are also major producers of fruits, vegetables, and certain domestic animals, thus increasing fat and protein production, and providing an important source of organic fertilizer supply. But their existence has long been a subject of debate. At issue is the competition for resources, particularly labor, between the private plots and the collectivized sector.[61] At times, there have been pressures to eliminate or curtail the private plots. The decline in their production in recent years was blamed in the press on the "gang of four" who were alleged to have vilified private plots as "supplying blood to capitalism." [62]

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[53] The "20 Articles" makes the following proposal on wages: "We must gradually raise the wages of workers receiving low wages and reduce the gap between high and low wages. * * * Every year or every 2 years we should raise the wages of a number of workers." (The China Business Review, vol. 4, No. 5, September-October 1977, p. 9.)

[54] When Vice premier Yu Chiu-li announced wage increases in his report to the Standing Committee of the Fourth National People's Congress in October 1977, he also stated: "We must study and settle the problems of how to * * * raise labor productivity * * * and how to apply better the principle "from each according to his ability, to each according to his work" and to insure "more pay for more work and less pay for less work" in distribution. (People's Daily, Oct. 25, 1977, p. 4.) The People's Daily of Feb. 27, 1978, which published a summary of Hua's report, carried an article by Yen Shi-chih entitled "To Firmly Uphold the Socialist Principle of Distribution According to Labor," advocating more pay for more work. The same theme was also advanced in Li Hung-lin, "To Each According to his Work: Socialist Principle in Distribution," Peking Review, No. 7, Feb. 17, 1978, pp. 6–8.

[55] Chao Li-kuang, "Refute the Gang of Four's Erroneous Theory Dealing with the Problems Concerning the Forms of Labor Payments," People's Daily, Nov. 22, 1977, p. 2.

[56] Ibid. See also Wang Hai-po, "To Insist the Combination of Politics in Command with Material Encouragement," People's Daily, Feb. 22, 1978, p. 3.

[57] Per capita real income in the rural areas has increased significantly in the past, but their consumption level still remains considerably below that in the cities.

[58] Hua's Report to the Fifth NPC: and Commentator, "The Key to Bringing into Full Play the Peasants' Socialist Enthusiasm Lies in Implementing the Party's Rural Policies," People's Daily, Feb. 15, 1978, p. 1.

[59] People's Daily, Nov. 14, 1977, p. 1.

[60] It has been estimated that about 20 to 30 percent of total peasant household income was derived from private plots. See Kenneth R. Walker, "Organization for Agricultural Production," in Alexander Eckstein, Walter Galenson, and Ta-Chung Liu (Eds.), "Economic Trends in Communist China," Chicago: Aldine Publishing Co., 1968, p. 431.

The current leadership regards the continued maintenance of private plots and sideline production as a means of reinforcing material incentives.[63] The range of production activities allowed to be generated from private plots is likely to expand,[64] and local free markets will be liberalized as an outlet for produce from private activities [65] But the Government is confronted with the difficult problem of insuring an adequate supply of labor input in collective production without having disincentive effects on private production. The difficulty is compounded by labor shortages, particularly during peak seasons, as more and more rural labor is absorbed into small-scale industry and is being mobilized to work on farmland construction projects.

A significant part of the improvement in China's rural real income in the past has resulted from the Government policy of raising the prices of agricultural products more rapidly than the prices of industrial products. Between 1957 and 1974–75, agricultural purchase prices increased about 65 percent, while the prices of industrial products sold to farmers rose by less than 15 percent.[66] The prices of certain producer goods sold in rural areas, such as chemical fertilizers, pesticides, and diesel oil, have declined significantly.[67] Present policy calls for a continued improvement in the terms of trade for farmers.[68] The prices of certain producer goods used by farmers will continue to decline.[69]

2. Manpower Utilization

Closely related to the wage and incentive issue is the problem of manpower utilization. In the past few years, some communes experienced a decline in farm output resulting from a sharp reduction in the number of agricultural workers directly engaged in production. The reduction was due to several causes. First, many agricultural workers were shifted to perform nonproductive activities allegedly under the "gang of four" influences.[70] The problem became serious enough for Hua Kuo-feng to stress it in his report to the 11th Party Congress in August 1977, and then again to the Fifth NPC in February

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[61] For example, a tendency exists for the peasant to devote much of his and his family's labor to his plot at the expense of their labor input in the collective.

[62] FBIS, July 22, 1977, p. E8.

[63] Hua's Report to the Fifth NPC, and article 7 of the Constitution of the PRC (1978).

[64] A commentary in the July 21, 1977, People's Daily strongly defends sideline production by commune families for "playing an important role in the national economy." But it cautions that "(rural sideline) production should be regarded as proper and not be interfered with if it does not * * * disturb agricultural production, affect collective production and collective labor." See also a New China News Agency commentary entitled "Pig Raising Needs a Big Development," in People's Daily, Feb. 13, 1978, p. 4.

[65] Theoretical Group, Office of Agriculture, Revolutionary Committee of Liaoning Province, "Never Let the Party's Rural Policy Be Undermined," People's Daily, Nov. 16, 1977, p. 2; and Tung Tai, "Is Rural Trade Fair Capitalist Free Market?". People's Daily, Jan. 31, 1978, p. 3. For a discussion of the current policy toward rural trade fairs, see David Bonavia, "Very Private Enterprise," Far Eastern Economic Review, vol. 99, No. 9, Mar. 3, 1978, pp. 22, 25.

[66] Alexander Eckstein, "China's Economic Revolution," New York and London: Cambridge University Press, 1977, p. 303.

[67] Peking Review, No. 41, Oct. 10, 1975, p. 9.

[68] Hua's report to the Fifth NPC.

[69] In his summary report at the Third National Conference on Agricultural Mechanization, Yu Chiu-li disclosed the target of a 20-percent reduction in the cost of production for agricultural machinery. Its retail price also would be lowered correspondingly. (People's Daily, Jan. 29, 1978, p. 3.)

[70] People's Daily, Mar. 15, 1977, and Sept. 3, 1977, p. 1.

1978. Second, as noted earlier, farmworkers were increasingly hired away by rural industrial plants which expanded rapidly in recent years. Third, some peasants were said to have abandoned farming and engaged in commercial activities.[71] Finally, cadres at county, commune, and brigade levesl gradually dropped out of the system of participating in production for 100, 200, and 300 days each year, respectively.

The Chinese press has reported the return of many workers to productive activities,[72] but in 1978 the problem remained unresolved in many localities.[73] To achieve an optional distribution of rural labor between agricultural production and other occupations, such as rural industry and farmland capital construction, will be a most difficult task. In the early 1960's, the then Minister of Labor once specified 80 percent as a guide for the allocation of rural work force to the "forefront" of agriculture.[74] But it does not seem to make much sense for all communes in China to follow one unified procedure for manpower distribution because of wide variations in local conditions. Later, local governments were granted greater authority to determine an appropriate distribution of the labor force under their own jurisdiction. It seems that the production team now is given the primary responsibility for rural manpower planning, while counties, communes, and brigades must consult with the team on any planned diversion of manpower form "frontline" production to farmland capital construction projects or to commune-and brigade-run enterprises.[75]

Poor labor management is also a serious problem in the industrial sector. As in agriculture, there has been a large increase in nonproductive personnel in industry in recent years. In some industrial enterprises, the proportion of nonproductive personnel rose to as high as 30 to 40 percent of the total work force.[76] But unlike many rural communes where labor shortages are experienced during peak planting and harvesting periods, surplus labor persists in a large number of industrial enterprises due in part to the "slackness" and flexibility characteristics of Chinese industrial planning.[77] The "slackness" is most frequently reflected in industrial enterprise operations. Thus, during his visit to China in late 1972 and early 1973, a time when Chinese industry was in a new wave of expansion, the late Alexander Eckstein saw in Chinese factories "many workers * * * standing around more or less idle".[78] Further, during periods when there were strong pressures to fulfill or overfulfill output targets, enterprises tended to hire additional labor to insure that their production flow would remain uninterrupted. This was made possible by usually lax enforcement of the controls on the part of the local labor bureaus and the banks which were charged with the responsibility for overseeing labor and wage-bill allocation. As a result, labor hoarding and overstaffing became common in Chinese industrial enterprises.

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[71] People's Daily, Sept. 3, 1977, p. 1.

[72] In Shansi Province, for example, over 400,000 workers have returned to productive activities between October 1976 and September 1977. (People's Daily, Sept. 3, 1977, p.1).

[73] In Hsiao-pan Commune in Tien-men County, Hupeh Province, for example, nonproductive personnel accounted for 19 percent of the total labor force in 1977. (People's Daily, Feb. 17, 1978, p. 1.) Another article in the People's Daily (Feb. 15, 1978, p. 1) reported that production teams in many localities still had large numbers of nonproduction personnel and shortages of labor on the "agricultural frontline."

[74] Red Flag, No. 5, 1961, p. 11.

[75] The percentage of rural labor allocated to "frontline" production varies in different provinces. In Kansu Province, for example, at least 60 percent of Rural Labor is now required to be assigned directly to agricultural production, while the target for Shansi Province is set at 70 percent. Within a province, the labor target also may vary for different localities. In Chinchung Prefecture of Shansi Province, for example, after the consultations of the prefecture with counties, communes, and teams, the targets have been determined as follows: While no less than 70 percent of the labor force is required to stay in the fields, 10 percent can be organized into specialized teams for farmland and capital construction round the year, a maximum of 5 percent can be hired by commune-run enterprises, and no more than 3 percent can be transferred to counties or above. (People's Daily, Sept. 3, 1977, p. 1.)

[76] "20 Articles."

[77] For a discussion of such "slackness" and flexibility in Chinese planning, see Eckstein, op. cit., pp. 92–96.

[78] Eckstein, p. 95.

Urban unemployment and underemployment are commonly found in an underdeveloped, labor-abundant economy such as China's. Part of the Chinese solution in the past has been mass exodus of workers and other types of personnel from the cities to the countryside. The problem, however, remains serious. In the past year, measures have been taken to strengthen labor management by instituting the "system of responsibility" in enterprises and by tightening the control over labor allocation.[79] In the long run, the problem also could be ameliorated by the development of labor-intensive industries, such as those for producing exports, and of the service sector, such as tourism, and by the return of millions of students to colleges and universities.[80]

3. *Industrial Management*

One area of the Chinese economy most profoundly disrupted by political and ideological disputes over the last decade was industrial management. Many enterprises failed to observe the rules and regulations established to manage production, or none were set up.[81] The following description of the state of industrial enterprises in China is quite striking:

> ". . . due to the serious interference and sabotage of the gang of four, in recent years management in many enterprises has been poor, the quality of products has been bad, the proportion of equipment in use has been low, consumption of raw materials, other materials, fuel, and electric power has been high, loses have been extensive and great, and the level of accumulation has fallen." [82]

Therefore, Chinese planners are confronted with the pressing task of reestablishing managerial systems and discipline. One critical and difficult problem is to effectively assess and check the performance of enterprise operations. For many years industrial enterprises in China have been evaluated and controlled on the basis of eight "economic and technical targets." [83] While these targets are assigned simultaneously, they do not always reinforce each other. In fact, some are mutually competitive. For a certain enterprise one target may be given highest priority while in another, none is clearly designated as the principal success indicator.

In the 1950's when the gross value of output was assigned highest priority, there was considerable waste in resource use. In an effort to maximize gross output value, enterprises tended to raise the cost of labor and materials used and also hoard them to insure an adequate supply of inputs. In the 1960's gross value of output still remained the key target for some enterprises,[84] while for most others the value of marketable output seems to have become a major success indicator.[85] Eckstein's observations in his trip during 1972–73, led him to believe that "at least since the Cultural Revolution, output of major products measured in physical terms has emerged as the most widely used indicator of enterprise performance."[86]

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[79] Hua's report to the Fifth NPC.

[80] Chinese policies dealing with exports, tourism, and education are discussed in the following two sections.

[81] Theoretical Group of the Office of Economization, SPC "Whoever Economizes Will Produce More," People's Daily, Aug. 9, 1977, p.3.

[82] This statement was made by the Kwangtung Provincial Conference on Enterprise Management in September 1977. (FBIS, Sept. 19, 1977, p. H4.)

[83] These are: (1) output; (2) variety; (3) quality; (4) consumption of raw materials, other materials, fuel and power; (5) labor productivity; (6) cost; (7) profit, and (8) the working capital ratio.

[84] Dwight H. Perkins, "Industrial Planning in the PRC," The China Business Review, Vol. 4, No. 5, Sept.-Oct. 1977, pp. 3-7, 10-11.

At present Chinese planners are insisting on increased emphasis on targets relating to quality, consumption of material inputs and cost.[87] This is due largely to the planners' concern over poor quality and indiscriminate use of material inputs, both factors still seriously plaguing industrial production in China. Many major production units produce substandard products and consume inputs far more than they need.[88] It has been estimated, for example, that if appropriate measures are taken, 60 million tons of raw coal, 6 million tons of coking coal, and more than 6 million tons of fuels could be saved in industrial enterprises throughout China.[89] Enterprises are now urged to give product quality first priority,[90] and to correct "serious cases of wastefulness such as making no plans regarding requisition of materials, setting no limit on the consumption of materials and misuse of resources." [91]

China has begun to push forward a major plan to reorganize the farm machinery industry in the next 3 years, based on specialization and coordination of various plants within either a province or a few neighboring provinces.[92] Production of machines and parts is to be "standardized, serialized, and generalized." Beginning this year, products shall not be allowed to leave the plant and included in the final output figures if they fail to meet the criteria for quality, variety, and specifications or the requirements of a contract. Enterprises shall recall all of those products which do not meet these criteria or requirements but have left the plants, and be responsible for all expenses involved. Although these steps are taken in connection with the major reform of the farm machinery industry, the Chinese have made it known that similar measures will be adopted for other industries.[93]

The greater emphasis the planning authorities attach to quality and cost does not mean that the pressures on enterprises for output maximization will be eased. On the contrary, improved quality and more economical use of resources are seen as a means of accelerating growth in output.[94] In the past the pressures for output maximization were usually much greater than for economizing on materials and raising quality. Enterprises now are required to secure the maximum possible increase in the output of products of acceptable quality from a given bundle of inputs. To evaluate whether an enterprise has achieved this goal, the best guide among the eight performance indicators in use is probably the profits target.

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[85] Eckstein, op. cit., p. 96.

[86] Ibid., p. 97.

[87] This is evidenced in Yu Chiu-li's October 1977 report to the NPC Standing Committee and in a seriee of editcrials, commentaries, and articles published in both the People's Daily and Red Flag especially sincs August 1977.

[88] Hua's Report to the Fifth NPC; Editorial, "Everyone Must Oppose Waste and Strive to Reduce Consumption in Production," People's Daily, Sept. 25, 1977, p. 1; and Commentator, "Without Top Quality, There Will Be No High Speed," Pecple's Daily, Oct. 30, 1977, p. 1.

[89] People's Daily, Aug. 9, 1977, p. 3; and Sept. 25, 1977, p. 1.

[90] Editorial, "Quality Must Be Given First Priority," People's Daily, Aug. 17, 1977, p. 1.

[91] People's Daily, Sept. 25, 1977, p. 1.

[92] See Yu Chiu-li report to the Third National Conference on Agricultural Mechanization, People's Daily, Jan. 29, 1978, pp. 1–3.

[93] Ibid.; and Hua's report to the Fifth NPC.

[94] Hua Kuo-feng said to the Fifth NPC, "Failure to achieve high quality, economize on materials, and provide the state with constantly increasing profits will make it impossible for the economy to achieve sustained and high-speed development." Commentator "Struggle for Develcping the National Economy at a High Speed," Red Flag, No. 1, Jan. 5, 1977, p. 15; and Commentator, "Reliance on Better Quality and Economization for Obtaining Greater and Faster Increases in Output—An Important Problem in the Struggle for High Speed," People's Daily, Jan. 27, 1978, p. 1.

This target has been at the center of ideological controversy since the founding of the People's Republic. In the early 1960's there was a debate on whether the profits target should be used as a key success indicator. Proponents of the profits target were criticized for trying to "out-Liberman" Liberman, and later were purged during the Cultural Revolution.[95] Although profitability remained one of the performance targets after the Cultural Revolution, this target was constantly under attack from the "radicals." The attack was intensified in 1975–76.

In order to avoid the charges of "putting profits in command" and "making profits is criminal," enterprise managers paid scant attention to profitability. The profits target was either ignored or viewed as a secondary criterion. As a result, the profits of many enterprises declined and some were run at a loss.[96] This, in turn, led to underfulfillment of the planned targets for budgetary revenues during 1974–76 because enterprise profits were the major source of the state revenue.[97]

All enterprises now are urged to perform the glorious task of increasing profits. It is too early to tell if Chinese planners will use profits as the key indicator of enterprise performance. But the profits target is assigned a degree of importance at least equal to that of most of the other seven targets.[98] A number of articles appeared in 1977 and early 1978 to provide an ideological justification for the profit concept. Quoting Engels, Lenin, and Mao, these articles attempt to legitimize the notion that socialist enterprises should make profits, arguing that "in China * * * profits are the monetary manifestation of a part of the surplus product created by the working class for society" and that profits are the source of accumulation on which expanded production and hence the "four modernizations" depend.[99]

4. Economic Planning

The disarray in economic management occurred not only at the micro level, but in national planning as well. The candid assessment of Chinese economic planning by Vice Premier Yu Chiu-li, head of the SPC, is quite revealing:

> * * * (F)or the past several years the national economy was in fact developing in a semianarchical fashion. A significant proportion of economic activities was not included in the unified plan; some of those included did not function strictly

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[95] Yevset Liberman, a Soviet economist, in the early 1960's presented proposals for reforms in the planning and management of the Soviet economy. According to one of his proposals, enterprise performance would be assessed in terms of profitability and bonuses would be paid out of the profits. The leading proponent of the profits target in China at that time was Sun Yeh-fang, head of the Economic Research Institute of the Chinese Academy of Sciences. Sun was purged during the Cultural Revolution, and has reemerged in Peking recently.

[96] The problem reached serious proportions in 1976. In that year, for example, at least 68 percent of the enterprises in the machinery industry in Szechwan Province did not make profits. In Ping-ting-shan City of Honan Province 31.7 percent of the enterprises experienced losses. (People's Daily, Aug. 27, 1977, p. 1 and Nov. 11, 1977, p. 2; and Red Flag, No. 8, Aug. 1977, p. 74.)

[97] The trend was reversed last year. The state revenue in 1977 exceeded the target planned at the beginning of the year by 6 percent, reaching a record level. (People's Daily, Jan. 9, 1977, p. 1.)

[98] Editorial, "Work Hard to Increase Accumulation for the State," People's Daily, Aug. 27, 1977, p. 1.

[99] Chin Nan, "Accumulation Is An Important Task of Socialist Enterprises," The Nanking University Journal, No. 2, June 1977, pp. 47–49; Theoretical Group of the Ministry of Finance, "Accumulate More Funds for Building A Powerful Socialist State," Red Flag, No. 8, August 1977, pp. 70–73; Hsu Ti-hsin, "On the Problem of Profit Under Socialism," People's Daily, Nov. 22, 1977, p. 2; Editorial, "To Accumulate More Funds for High-Speed Development," People's Daily, Feb. 23, 1978, pp. 1, 2.

according to plan. In order to put our national economy on the proper footing, we must stress planning. Major economic activities must be incorporated in the state plan.[1]

The difficulties in Chinese economic planning are largely reflected in the issue of centralization versus decentralization. In 1957, China shifted away from a centralized economic system by transferring a broad range of economic decisionmaking and management functions from the central to local governments. But the central government continued to determine overall economic policies and the output targets for essential products and retained considerable power of control over main resource allocation decisions.[2] The decentralization measures were intended to introduce elements of flexibility into planning and plan implementation so that resources could be more efficiently allocated and utilized. But througout the past two decades of decentralization the planning system was fraught with problems and difficulties, particularly when decentralization was carried to excess. Excessive decentralization usually emerged when central control appeared weak or when the relations between the central and local governments became unstable.

Thus during periods of weakened central authority, such as the Great Leap Forward, the Cultural Revolution, and the anti-Confucius and anti-Teng campaigns, decentralization became so prevalent that at times some local governments resisted transferring funds to the central government.[3] In 1976, some provinces and municipalities, including Shanghai, Liaoning, and Szechwan, are said to have been trasformed into "independent kingdoms," disregarding the state's unified allocation plan and intercepting shipments destined for other provinces.[4]

Excessive decentralization during periods of weakened central control led some students of the Chinese economy to believe that there existed in China a separate local system of economic planning associated with the so-called cellular production structure.[5] In reality, however, it seems that the decentralization policy adopted since 1957 has retained many features of central control over resource allocation prevalent during the First Five-Year Plan. The national leadership is now taking steps to reassert the central government's control over key economic decisions. In addition, emphasis is being placed on strengthening unified planning by different levels of authorities.[6] Hua Kuo-feng has singled out the strengthening of unified planning as one of the key measures to be adopted for solving China's economic problems.[7] In this respect, the recent report of Yu Chiu-li on agricultural mechanization is most instructive.

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[1] People's Daily, Oct. 25, 1977, p. 2.

[2] The SPC lists the following decisionmaking areas which should fall under the ambit of the central government: (1) the guidelines and policies of the national economy; (2) output targets for major industrial and agricultural products; (3) basic construction investment and major construction projects; (4) allocation of important materials; (5) the purchase and allocation of key commodities; (6) the state budget and the issuance of currency; (7) the number of workers and employees to be added and total wage bill; and (8) the prices of major industrial and agricultural products. See SPC, "A Great Guiding Principle of Socialist Construction," People's Daily, Sept. 12, 1977, p. 2.

[3] In 1975 and 1976, Human and Shansi Provinces refused to deliver to the state the amount of funds which would have bee sufficient to build two railway lines between Peking and Tientsin, or 6 100-megawatt thermal power stations. One other unnamed province in 1976 alone illegally used the funds originally allocated to industrial enterprises as working capital in an amount equivalent to the construction cost of 14 100-megawatt thermal power stations. ("Strengthen Financial Management, Quickly Bolster the National Economy," People's Daily, Nov. 6, 1977, p. 2.)

[4] An article in the People's Daily (Jan. 14, 1977) reported: "Originally, our country's comprehensive 1976 plan for a balance in fuel and raw materials, a sound plan drawn up through overall coordination, had already been approved by the central authorities. However, the "gang of four" directed their minions in Shanghai and Liaoning * * * to willfully change the coal-consuming enterprises into oil consuming ones.* * * In 1976 alone, * * * the "gang of four" in Liaoning had willfully increased the number of oll-consuming units by more than a hundred. Shanghai's crude oil consumption for 1976 exceeded the plan by 1 million tons. * * * (The "gang of four") forced the central departments concerned to give their approval to intercept crude oil at Shanghai harbor destined for fraternal privinces and municipalities. * * * " ("A Grave Step for Usurping Party and State Power," People's Daily, Jan. 14, 1977, p. 2.) Peng Chun, "Fully Utilize and Actively Develop Shanghai's Industry to Make a Greater Contribution to the Achievement of Four Modernizations," Red Flag, No. 12, Dec. 5, 1977, pp. 14–21.

[5] See Audrey Donnithorne, "China's Cellular Economy: Some Economic Trends Since the Cultural Revolution," China Quarterly, No. 52, October–November 1972, pp. 605–19.

As noted above, the current plan to reorganize the farm machinery industry is based on the principle of the division of labor and specialized coordination. To be effective, these principles must be implemented by "every enterprise, commune, county, and prefecture under the respective authorities' unified plans".[8] Thus the use and management of farm machines are to be organized by the brigade or commune. The repair and maintenance of farm machines are to be under the unified planning and management at the county level. The production, supply, and marketing activities of commune and brigade-run enterprises are to be included in the plans of county and higher levels. The "standardization, serialization, and generalization" of major farm machines are to be carried out under the direct supervision and unified planning of the provicial government.

A major problem facing the central planning authorities is to derive an optimal pattern of control, in which decentralized management would not lead to disruptions in economic planning and coordination and, at the same time, centralized control over major resource allocation decisions would allow sufficient flexibility in the planning system to assure efficient utilization of resources. The division of the country into six economic regions, which would introduce a new level of planning between the central and provincial governments, could facilitate the search for such an optimum. The establishment of these so-called major regions as a way of handling the relations between the central and local authorities has both pros and cons, which, as alluded to above, were discussed by Mao two decades ago. The available information on the structure and function of the major regions is so fragmentary that their role in Chinese economic planning can not be fully understood at this time.

5. *Investment Allocation*

The establishment of a comprehensive industrial system and acceleration of overall economic growth depend on the rapid development of basic material-producing and investment-goods industries. Hua has called for "accelerating the development of basic industries." [9] This will require major allocations of resources for such industries as electric power, coal, petroleum, chemicals, machine building, steel and other metals, as well as for transport. Because of years of insufficient investments, some of these sectors, particularly electric power, coal, and transport, have become weak links and now are given top priority in the allocation of investment. The strategic importance of these sectors was stressed in the 1978 New Year's Day joint editorial:

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[6] Decentralization is encouraged, but only under "unified planning". In a major policy paper, the SPC, after paying due attention to a Mao's quotation "***It is far better to have the initiative come from both the central and the local authorities than from one source alone." (On the Ten Major Relationships), issued a stern warning: "We must oppose departmentalism and decentralism which only take into consideration the interests of a given locality or department at the expense of those of the whole nation. (People's Daily, September 12, 1977, p. 2.)

[7] People's Daily, Feb. 27, 1978, -pp. 1,4.

[8] People's Daily, Jan. 29, 1978, p. 2.

Hua's Report to the Fifth NPC.

"With these 'precursor departments' running in the van, the industries producing iron and steel and raw and semifinished materials will follow up." [10] Thus a major portion of the supplementary appropriations for 1977, which became available because of a 6-percent overfulfillment of the State revenue target, was used for additional investment in these priority sectors.[11]

At the same time, the post-Mao leadership is facing heavy pressures for increased investment in other major sectors, particularly defense, consumer goods industry, and agriculture.

The need for defense modernization is generally recognized in China. The Hua government, relying on the support of the People's Liberation Army, is under pressure from the military establishment to step up defense modernization, reversing the cutback of the early 1970's. The leadership, however, stresses the close tie between defense modernization and the development of the national economy as a whole, reaffirming Mao's principle: "To strengthen national defense we must first strengthen economic construction." [12] It is argued that at the present stage of Chinese economic development a rapid expansion of both basic industries and scientific and technological capabilities must precede large-scale production of tanks, bombers, fighters, missiles, and other implements of war. Chinese media articles seem to suggest that the argument has not been accepted by all elements of the military and its supporting industrial establishment. Some have implicitly expressed their concern that concentrating on the long run development of the industrial base could invite aggression and increase the possibility of war in the short run by virtue of weakened defense capability. Thus they see the necessity for defense modernization at least to keep pace with the modernization of other sectors. A recent editorial in the Liberation Army Daily implied that these minority views were not strong enough to have a major impact on the leadership's position.[13]

Meanwhile the need for increased investment in the consumer goods industry is also great. Hua has called for the consumer goods industry to "turn out an abundance of first-rate, attractive, and reasonably priced goods to support a considerable increase in per capital consumption." [14] Increased consumer goods output is also necessary to keep pace with population growth and help expand the exports needed to exchange for more machinery imports. But two recent articles by the Ministry of Light Industry provide no indications that there will be a significant increase in investment in the consumer goods industry.[15] While acknowledging that the rate of growth of the industry was too slow to meet increases in both domestic consumption needs and export requirements, the Ministry implicitly suggested that to assure the expansion of consumer goods production in the long run present priority would be given to the development of those industries producing inputs to it. Two such industries were singled out: the petro-chemical industry which provides some 30 percent of the raw materials used in consumer goods production, and the machine building industry which was capable of manufacturing complete sets of specialized equipment for over 30 branches of light industry.[16]

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[10] People's Daily, Jan. 1, 1978, p. 1.

[11] People's Daily, Jan. 9, 1978, p. 1.

[12] Mao Tse-Tung's Selected Works, pp. 271–72. For a discussion of the relations between defense modernization and the development of major economic sectors, see the joint editorial issued on the 50th anniversary of the founding of the People's Liberation Army, "Accelerate Modernization of National Defense," Red Flag, No. 8, Aug. 8, 1977, pp. 18–20.

[13] The Liberation Army Daily editorial, reprinted in the People's Daily (Jan. 26, 1978), stated, "It is imperative to adhere to the principle of practicing economy in army building, to take the overall situation into consideration, to correctly understand the relationship between national defense and economic construction, * * * to do our utmost to save and reduce the expenditures of the armed forces, and to step up national economic construction. Rapid development of economic construction will certainly bring about a great stride forward in national defense construction."

[14] Hua's Report to the Fifth NPC.

[15] Theoretical Group of the Ministry of Light Industry, "March Forward Along the Road Toward Industrialization Chartered by Chairman Mao," Red Flag, No. 2, 1977, pp. 40–45; and "The Fundamental Road to the Development of Light Industry in China," People's Daily, Oct. 28, 1977, p. 2.

Accelerated economic and industrial growth depends on high rates of agricultural development. To achieve the target of annual growth rates of 4 to 5 percent for the gross value of agricultural output during 1978–85, as specified in the 10-year Economic Plan, the state will allocate more resources to the agricultural sector.[17] In view of the ambitious program for a major reform and expansion of the agricultural machinery industry, a significant amount of state investment is also expected to be allocated to that industry and other industries which supply inputs to it.

Inasmuch as the current emphasis in agricultural development is on mechanization, state funds channeled directly to the communes will be used by poor communes and brigades mainly for purchasing agricultural machinery and developing commune- and brigade-run enterprises. In addition, the state will provide poor communes and brigades with interest-free loans to be paid back in 1 to 15-year periods.[18]

In the long run, however, mechanization is to be financed mainly by increased communal savings. To the extent that it is difficult for most communes to expand farm production while continuing the strict restraints on consumption, the chief method for augmenting communal savings is to generate more income through nonfarm activities. The emphasis is on the development of commune- and brigade-run enterprises, especially small iron ore and coal mines, power stations, and cement and chemical plants.[19] To encourage the expanded development of these enterprises, the government will adopt tax-free and favorable procurement price policies.[20]

IV. Human Resource Development

In March 1977, Hua Kuo-feng issued a call for "initial success in 1 year and marked success in 3 years in * * * bringing about great order across the land." Less than a year later, the People's Daily announced that this desired "initial success" had in fact been achieved.[21] As far as the economy was concerned, however, the results were mixed. Agriculture continued to be plagued by low labor productivity and poor weather conditions, with virtually no improvements in grain output last year. Rapid industrial recovery was made possible partly by bringing idle capacity back into operation. It is difficult to assess to what extent increases in output could be attributed to the reduction of inefficiency in the various issue areas enumerated above. Reports from China seem to indicate that the drive to improve economic efficeincy has begun to pay dividends. But the inefficiency in the Chinese economy is great and widespread; the drive to reduce it is just beginning and will take some time for its full impact to be felt on economic growth. Improvements in economic efficiency, therefore, could contribute significantly to "marked success" in the remainder of the Fifth Five-Year Plan and beyond.

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[16] In his report to the Fifth NPC, Hua pointed out the necessity to "substantially increase the ratio of such petro-chemically produced raw materials as chemical fibers and plastics to all raw materials used in light industry."

[17] Hua's Report to the Fifth NPC: and Editorial, "To Speed up Agricultural Development Is a Fighting Task of the Whole Party," People's Daily, Dec. 11, 1977, pp. 1-2.

[18] See Yu Chiu-li report to the Third National Conference on Agricultural Mechanization in the People's Daily, Jan. 29, 1978.

[19] In 1977, 17 million commune members worked in more than 1 million commune- and brigade-run enterprises which were set up in 90 percent of the communes and 70 percent of the production brigades. Total output value of these enterprises last year made up 23.1 percent of the total income of the communes, brigades and teams combined. (FBIS, Oct. 14, 1977, p. E9; and Jan. 6, 1978, pp. E17–19.)

[20] People's Daily, Jan. 29, 1978.

[21] Editorial, People's Daily, Jan. 1, 1978, p. 1.

But efficient planning and management alone cannot guarantee the sustained high rates of economic growth required for the four-modernizations drive. Over the longer run, the attainment of such rates must depend additionally on rapid technological progress, which in turn calls for substantial improvements in the quality of human capital.

Studies of the economic growth of developed and developing nations in the modern period show that the primary source of growth was improvements in quality of inputs—traceable to increases in the stock of scientific and technological knowledge, and the extension of its application to problems of economic production and organization.[22] Some of these studies suggest that the rapid spread of modern education must have been a basic element in increasing the capacity to exploit and contribute to the available stock of tested and useful knowledge.

1. Shifts in Science and Education Policy

When the People's Republic was established in 1949, China was grossly deficient in technical manpower. In the 1950's, China's industrial technology, scientific research, and education were all profoundly influenced by the Soviet system. A large number of Russians worked or lectured in China, and many Chinese received training in the Soviet Union.[23] Meanwhile, domestic education and training were expanded. School enrollment at all levels rose sharply.[24] Apart from formal academic institutions, there was a proliferation of "spare-time" schools and inplant training courses to upgrade skills. Secondary vocational schools were also established, some attached to factories, others independent.

Following is a Western expert's assessment of China's educational development between 1949 and 1966:

> (China) has managed to create and operate an educational system that is ideally suited to her conditions and goals. * * * She has encouraged an atmosphere of learning, has made literacy among the masses one of the primary goals, has managed to elevate the overall educational level of rural youth, has trained adequate numbers of middle-level specialists and technicians, while, at the same time not neglecting the economy's requirements for higher level professional personnel,

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[22] For example, Kuznets' findings indicate that only less than 20 percent of the secular growth of production per capita was attributable to increase in inputs per head of man-hours and material capital, and that the basic cause for the growth was improvements in quality, not quantity, of inputs. See Simon Kuznets," Modern Economic Growth: Rate, Structure, and Spread," New Haven and London: Yale University Press, 1966.

[23] About 11,000 Soviet scientists and technicians worked in China, half in industrial enterprises. Over 700 Russians lectured in universities and technical schools, helping to establish new departments and laboratories. At the same time, some 38,000 Chinese received training in the Soviet Union: half of them were workers, and the others included 7,500 students (of whom 2,000 were graduate students) and 1,300 scientists.

[24] Total school enrollment at all levels reached 130 million on the eve of the Cultural Revolution. (Ta Kung Pao, Weekly Supplement, No. 597, Nov. 24–30, 1977, p. 7.) In higher eductaion, engineering absorbed from 30 to 40 percent of all students. The next largest groups were those undergoing teacher training, with physical science third. See Leo A. Orleans, "Communist China's Education: Policies, Problems, and Prospects," In Joint Economic Committee, "An Economic Profile of Mainland China," Washington, D.C., 1967.

particularly engineers and scientists. China has done this with a minimum of disruption to industrial productivity, in most instances, by combining education with work, and at a minimum cost to the State.[25]

China's pragmatists probably would agree with every point in this appraisal. On the other hand, the now widely criticized, so-called two estimates of the "gang of four," which first surfaced in 1971 but had not been openly challenged until toward the end of 1977, asserted that in the first 17 years of the People's Republic "the bourgeoisie had exercised dictatorship over the proletariat" on the educational frnot, and that the "world outlook" of the majority of teachers and students trained over those 17 years "had been chiefly bourgeois," leading them in effect to become "bourgeois intellectuals." [26]

During and in the aftermath of the Cultural Revolution, when the radicals' influence was predominant, drastic changes took place in China's science and education. Primary and secondary schooling combined were shortened from 12 to 9 or 10 years. The curriculum of institutions of higher education, which were closed for 3 to 5 years during the Cultural Revolution, was reduced from 4 to 3 years. College admission requirements were considerably eased.[27] Once the student was admitted to a college, his progress was evaluated on the basis of ideological fervor and political activism. Examinations and grades were frequently attacked as symbols of the bourgeois emphasis on intellectual and academic performance. As a result, the academic quality of college training suffered greatly.[28]

Further, many scientists, engineers, and technicians were dislodged from their places of work and transferred to rural communes.[29] Those who remained in their positions usually had to spend varying periods of time to engage in manual labor in factories or on farms. Many research institutes were closed down and research projects abolished. Between 1965 and 1973, for example, the number of research institutes in the Chinese Academy of Sciences was reduced by 40 percent and total manpower by one-third.[30]

Shifts in Chinese science and educational policy revolved around a wide range of issues, three of which have been most heatedly debated in recent years.[31] The most important of these appears to be the ever-present controversy of "red versus expert," or ideological commitment and political reliability versus professional knowledge and technical competency. The dogmatists place preponderant emphasis on "redness," advocating that "expertness" is an integral part of "redness." To them, zeal, dedication, and ideological commitment are necessary qualifications for being innovative and inventive. On the other hand, the pragmatists stress expertness, professionalism, and technical know-how, arguing that all these elements are themselves a manifestation of "redness." [32]

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[25] Leo A. Orleans, "A Critical Review of China's Education," a paper presented at the Fourth Sino-American Conference on Mainland China, Airlie House, Virginia, Dec. 12–16, 1974.

[26] Mass Criticism Group of the Ministry of Education, "A Major Polemic on the Educational Front—Criticizing the 'Two Assessments' Concocted by the 'Gang of Four'," Red Flag No. 12, Dec. 5, 1977, pp. 3–13.

[27] Entrance examinations were abolished, and prospective students were recruited from among those young workers, peasants, and discharged soldiers who had spent at least 2 years in factories or on farms.

[28] An Oct. 23, 1977, People's Daily article reported that among the college graduates given sample tests in Shanghai, 68 percent of them flunked mathematics; 70 percent, physics; and 76 percent, chemistry. The tests are said to cover "basic knowledge that high school students should know."

[29] In Kansu Province, for example, 60 percent of the technical manpower in the College of Agricultural Sciences and 75 percent in the Institute of Animal Husbandry were switched to other jobs. (FBIS, Aug. 18, 1977, pp. M1–M2.)

[30] Boel Billegren and Jon Sigurdson, "An Estimate of Research and Development Expenditure in the People's Republic of China in 1973," Industry and Technology Occasional Paper No. 16, OECD Development Center, Paris, France, July 1977, p. 18.

[31] Besides the three issues discussed here, frequently debated also were questions relating to mental versus manual labor, the leadership in science projects (party cadres or leading scientists), and the substitutibility of Marxist philosophy for natural sciences. See Peking Review, No. 44, Oct. 28, 1977 p. 8.

Closely related to the "red versus expert" issue is the role of intellectuals. As indicated above, Chinese intellectuals, including many of those scientists, engineers, and technicians trained before the Cultural Revolution, were regarded by the radicals as chiefly bourgeois. The "gang of four" is said to have held the view that "all the scientific and technical workers were intellectual aristocrats undermining the socialist foundation," and that "all specialists are bourgeois specialists and, therefore, must be overthrown." [33] The pragmatists, on the other hand, argue that intellectuals should not be the object of "dictatorship by the proletariat," but can be enlisted to make contribution to the "socialist revolution." Invoking Mao's dictum of "using all the people to their full capacity (for socialist construction)," they insist that the policy of "uniting with, educating, and remoulding intellectuals" must be upheld.[34]

The third issue relates to the questions of theory versus practice and basic versus applied research. The dogmatists advocate that scientific research and education should be geared to immediate, not future, needs. They are alleged to have been opposed to the basic sciences and theoretical research in favor of "mass or open-door scientific experiments," diffusion of existing knowledge, and application and adaptation of scientific findings to production. These concerns were reflected in the sending down of scientists to factories and farms to undertake highly applied research specific to the locality and adapt research findings to local conditions.

The pragmatists, however, point out that long-range interests are neglected as a result of preoccupation with present needs and highly applied research. They recognize the usefulness of "open-door research" and "mass experimentation" and the necessity to do highly applied research and solve "urgent problems in actual production." But they also believe that specialists should be allowed greater scope to conduct scientific work, including future-oriented theoretical research, without having to justify it in terms of immediate utility and practicality, and without frequent disruptions for political education. They believe further that absorption of scientific findings in foreign publications and adaptation of imported equipment to Chinese conditions require considerable basic research capabilities.[35]

2. *Current Emphasis on Science and Technology*

The downfall of the "Gang of Four" has led to drastic changes in the directions and goals of Chinese science and educational policy. The pragmatic proposals contained in the "Outline Report" which were blocked by the radicals now have gradually been translated into concrete programs. The post-Mao leadership seems to be fully aware of the vital importance of education, science, and technology in economic modernization. Soon after the "Gang" was toppled, Hua Kuo-feng announced, "In the next 23 years we shall have to make the modernization of science and technology lead the way, so as to contribute to the modernization of industry, agriculture, and national defense." [36] More recently, he stressed once again, "Without reaching a high level of science and education, a nation can in no way realize the four modernizations." [37]

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[32] The Theoretical Group of the State Geological Bureau. "One Flag of Being Both Red and Expert—Learning from Comrade Li Sze-kuang," Red Flag, No. 11, November 1977, pp. 24–28.

[33] FBIS, June 27, 1977, p. E5.

[34] Hua's report to the Fifth NPC.

[35] In the ' Outline Report," the Chinese Academy of Sciences asserts: "* * * (I)t is wrong not to criticize the tendency of belittling the role of the masses in scientific research and it is equally wrong not to give full play to the role of specialized research institutes and specialists * * *. (I)t is wrong not to call on scientific and technical personnel to do research and solve urgent problems in actual production: on the other hand, it is equally wrong to overlook or deny the importance of research in basic theory and the necessity of laboratory work." (Chung Ko, "The Struggle Around the Outline Report in Science and Technology," Peking Review, No. 44, Oct. 28, 1977, p. 8.)

For the first time, a separate article on science and technology is stipulated in the new Constitution of the People's Republic to "reflect the importance of vigorously stepping up scientific and technological work in carrying out the general task for the new period." [38] The key role of science and technology is also reflected in the elevation of Fang Yi, head of both the Chinese Academy of Sciences and the State Commission of Science and Technology, to a vice premiership, and in his election to China's highest policy making body, the Communist Party Politburo.[39] It is reflected further in the decision to increase the proportion of funds in the state budget for science and education.[40]

In September 1977, the Party Central Committee issued a directive to convene a national science conference in the spring of 1978. The purpose of the conference is said to be to "exchange experiences, formulate rules and plans, commend advanced scientists, and mobilize the nation and the scientific community for achieving the modernization of science and technology." [41]

At the same time, other steps were taken to strengthen scientific research and science education. The State Commission of Science and Technology has been reestablished directly under the State Council. The new commission is to coordinate with the SPC to balance out the plans made by various departments and localities, and then formulate a national program for science and technology as a component part of the national economic plan.[42]

Some of the research organizations abolished during the Cultural Revolution have been gradually restored. Scientists, engineers, and technicians who had been sent down to factories and farms have mostly returned to their positions. Professionals now seem to have a greater voice in the decisionmaking process, and some of them have been allowed to again lead research organizations.[43] Science professionals can spend more time on research and less on political study.[44] Professional titles have been restored, and technical performance is to be evaluated through a process of peer review.

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[36] FBIS, July 5, 1977. p. E2.

[37] People's Daily, Feb. 4, 1978, p. 2: and FBIS, Feb. 8, 1978, p. E8.

[38] Yeh Chien-ying's report to the Fifth NPC on the revision of the Constitution in the People's Daily, Mar. 2, 1978, p. 1. See also article 12 of the Constitution of the PRC (1978).

[39] It is believed that China is the only Communist country which has a member in the politburo representing the scientific establishment (New York Times, Sept. 27, 1977, p. 31).

[40] Peking Review, No. 2, Jan. 13, 1978, p. 17: and People's Daily, Jan. 9, 1978, p. 1.

[41] The Central Committee of the Chinese Communist Party's Circular on Holding National Science Conference (issued on September 18, 1977). People's Daily, Sept. 23, 1977, p. 1.

[42] Ibid.

[43] In the Chinese Academy of Sciences, for example, academic committees consisting of professional scientists have been set up in a number of institutes, including the institutes of physics, high energy physics, and silicate research. These committees make suggestions on the orientation, tasks, and plan of scientific research, assess research results, and help train and evaluate scientific and technical personnel. See Ta Kung Pao, Weekly Supplement, No. 597, Nov. 24–30, 1977, p. 4.

[44] Professionals now can devote at least five-sixths of their time to research," People's Daily, Sept. 23, 1977, p. 1; and Jan. 23, 1978, p. 2.

Greater attention has been given to basic sciences and theoretical research.[45] A draft plan for the development of basic sciences has been prepared jointly by the Chinese Academy of Sciences and the Ministry of Education.[46]

The plan calls for the establishment of a research system with moderized laboratories for major branches of the basic sciences within 8 years. An increasingly large number of professional meetings have been held by scientists throughout the country to discuss technical papers.[47] A meeting of the editors of over 40 natural science periodicals was held in Peking to discuss ways for improving the quality of natural science publications.[48]

In a report at the end 1977, Fang Yi outlined the major steps to be taken in the next 8 years. Within the next 2 or 3 years, there will be a major overhaul of scientific and technological work and an increase in the number of research institutes. By 1985, there should be a "cooperatively interacting scientific and technological research system rationally distributed throughout the country with a number of new modern research centers and major experimental facilities." [49] A tentative plan calls for "the concentration of efforts on making a breakthrough in the near future on a number of key scientific and technological problems in industry, agriculture and national defense." [50]

3. Post-Mao Educational Reform

To push science and technology forward will require sufficient numbers of high-grade manpower capable of mastering modern scientific and technological knowledge and of adding to it. China's goals, as sketched by Fang, are ambitious. A contingent of first-rate scientists and technicians will be created by the end of the century to "make outstanding theoretical contributions and technical inventions and, in the key branches of science and technology, to approach, reach or exceed the world's advanced levels." In addition, there will be "a professional contingent of several million people whose level is above that of university graduates," as well as a "mighty scientific and technical work force at the grass-roots level." [51]

To generate such a vast pool of scientific and technical manpower requires a sound educational system. Several major educational reforms have been undertaken. One of them has been the restoration of post graduate study with emphasis on advanced work in the basic sciences. Several thousand first-year graduate students will be admitted to various research institutes during the forthcoming academic year.[52] The Chinese Academy of Sciences has set up a graduate school in the Chinese University of Science and Technology in Peking, which will enroll some 1,000 students within 2 to 3 years.

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[45] Hua's report to the Fifth NPC.

[46] People's Daily, Oct. 26, 1977, p. 2; Nov. 8, 1977, p. 1; and Dec. 30, 1977, p. 2.

[47] Ta Kung Pao, Nov. 30, 1977, p. 3, and People's Daily, Dec. 23, 1977, p. 4.

[48] Peoples Daily, Jan. 24, 1978, p. 1.

[49] Fang Yi's Report to the Standing Committee of the Fourth National Committee of the Chinese People's Political Consulative Conference (Dec. 27, 1977), People's Daily, Dec. 30, 1977, p. 2.

[50] This point was also stressed in Hua's Report to the Fifth NPC.

[51] People's Daily, Dec. 30, 1977, p. 2.

[52] The number of post graduate students admitted in the forthcoming academic year was originally set at 3,000, but was increased later because of a large number of applicants. The number of specialized fields, to which graduate students will be admitted, has been increased from 200 to 302. (People's Daily, Dec. 23, 1977, p. 4; and Jan. 23, 1978, p. 4).

Another major reform has been the reintroduction of the college entrance examination system. The new policy allows for the selection of college enrollees on the basis of test scores, not political purity and personal background, without the customary 2-year break for manual labor. In December 1977, nearly 5.7 million college applicants, including workers, peasants, veterans, party cadres and high school graduates took entrance examinations for the first time since the Cultural Revolution.[53] Academic excellence is now emphasized in the college edication. Examinations and grades have regained their respectability. Political study will be reduced, thus allowing college students to devote more time to their academic studies. At the same time, the Ministry of Education has selected 88 "key" universities and colleges, on which emphasis will be placed in the effort to develop higher education. The number of these "key" universities and colleges will gradually expand as economic and educational development proceeds.[54]

To supply qualified prospective students for the revamped colleges, academic standards in the primary and middle schools will have to be improved.[55] As in higher education, the current plan also calls for the selection of a number of "key primary and middle schools" throughout the country. Priority will be given to these key schools in the allocation of resources including teachers and funds for teaching aid and library facilities.[56] A national conference on education is to be convened this year to discuss, among other things, a plan to make universal education at the middle school level in the cities and the junior middle school level in rural areas.[57]

In its effort to recover the ground lost during the Cultural Revolution and its aftermath in the fields of science and education, the Chinese leadership is confronted with certain difficult problems. The supply of qualified teachers and scientists to staff colleges and research institutes is extremely scarce, and will take a long time to expand. Physical facilities are very limited, and libraries and laboratories are inadequately equipped. Therefore, considerable amonts of investment are required to expand educational and scientific infrastructure and develop the laboratory equipment industry.

In the face of these problems, some supplementary measures are necessary. One such measure, which the Chinese have decided to adopt, is to place greater emphasis on some of the existing nonconventional programs such as the so-called "July 21" colleges (workers' colleges run by factories), the Communist labor universities" (peasant colleges), spare-time education, and on-the-job training." Special emphasis will be given to the "July 21" colleges. The manpower training program, recently formulated by the industrial departments in both the central and provincial governments, has assigned these colleges the task of training over half of the industrial technicians in the next 8 years.[58]

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[53] Peking Review, No. 2, Jan. 14, 1978, p. 30.

[54] People's Daily, Mar. 2, 1978, p. 3.

[55] An Aug. 19, 1977, Kuang-ming Daily article states, "Improvement of the quality of education must start with the primary school. The primary school is the foundation snd the middle school is the key. Only if the middle and primary schools are run well can there be a high starting point for the quality of college education." (U.S. Joint Publications Research Service, Translations on People's Republic of China, No. 397, Oct. 19, 1977, p. 8.)

[56] FBIS, Jan. 16, 1978, pp. E5–6.

[57] Peking Review, No. 2, Jan. 13, 1978, pp. 15–19. In his report to the Fifth NPC, Hua said, "By 1985, in the main, 8-year schooling should be made universal in the rural areas and 10-year schooling in the cities."

[58] People's Daily, Dec. 7, 1977, p. 1; Dec. 19, 1977, p. 3; and Dec. 30, 1977, p. 2; and "Schools of Diverse Forms," Peking Review, No. 7, Feb. 17, 1978, pp. 11–13.

A plan seems to be under consideration for sending students abroad for study and training.[59] Invitations could be extended to foreign scientists and engineers to visit China for short-term teaching and research, although the leadership is undoubtedly concerned about the pernicious effect that the presence of a large number of foreigners might have on the Chinese population. As an initial step, the Government conceivably might invite Western scholars of Chinese origin to lecture in China.[60] In the past several years a number of American-Chinese scientists have gone to China either to conduct joint research projects with the Chinese or present lectures at Chinese institutes.

V. Technology Imports

1. The Role of Foreign Technology and Equipment

The current drive fostering science and education will not significantly stimulate economic growth in the short run, since high-grade technical personnel cannot be turned out in significant numbers until after the mid-1980's, and will not become experienced enough to exert a major impact on economic growth until very much later. The time lost in training and research during the decade of the Cultural Revolution and its aftermath will create a considerable gap in the continuous process of human capital formation. Many of the Chinese scientists and engineers who have been the driving force of China's scientific and technological progress since 1949 were trained in the West and are now in their 70's or older. They are being succeeded by a generation which was trained in the first 17 years of the People's Republic, and whose quality must have been watered down considerably over the past decade. As the current middle-level and junior scientists and engineers move up, there will be a shortage of qualified personnel to replace them.[61]

To overcome the negative impact of the "lost decade" on economic growth in the years to come, the Chinese planners seem to have adopted a strategy of relying on increased imports of capital goods and industrial techniques. Technology and equipment imports typically provide the quickest and, perhaps most economical, way of rapidly promoting growth in an underdeveloped economy. Without large-scale imports of Soviet machinery and equipment, for example, China could hardly have engaged in mass production of a host of industrial products in the 1950's. Eckstein's estimate shows that if China had compltely cut itself off from imports, the country's average rate of economic growth between 1953 and 1957 would have been reduced by 1.5 to 3.5 percent a year.[62] A similar estimate for the 1970's is not available, but the large-scale acquisition of Western technology in the early 1970's probably will contribute significantly to industrial growth in the late 1970's and early 1980's.

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[59] The necessity of formulating plans to send students abroad for study and training was pointed out in Yu Wen, "Vigorously Strengthen the Study of Basic Sciences," People's Daily, Oct. 26, 1977, p. 2.

[60] Reportedly a plan is under consideration for inviting some 200 American-Chinese scientists to lecture in China. (Ta Kung Pao, Jan. 10, 1978, p. 1.)

[61] Hua's Report to the Fifth NPC.

[62] Alexander Eckstein, "Communist China's Economic Growth and Foreign Trade," New York: McGraw-Hill Book Co., 1966, p. 121.

China basically acquires Western technology in two ways.[63] One of them is through the exchange of trade exhibitions and trade delegations. In recent years, there has been an increased inflow to China of foreign exhibitions especially those featuring technologically advanced industrial products. In conjunction with these exhibits, technical seminars frequently are organized by the exhibiting country. Chinese scientists and engineers are brought from all parts of China to Peking or Shanghai to participate in these seminars. At the conclusion of these exhibits, display models of the most advanced equipment are usually bought by the Chinese and used as prototypes for study and copying. In addition, a large number of Chinese technical missions have visited abroad, gathering data on advanced technology. Most trade delegations received by the Chinese from industrialized countries are accepted on the basis of their presenting detailed technical seminars.

A far more important form of technology acquisition is complete plant imports, often accompanied by advisory assistance in plant assembly. China relied heavily on the Soviet Union for this form of technology acquisition in the 1950's, and turned to the West for modest imports in the 1960's.

In the 1970's, Chinese imports of Western plants rose sharply. The value of complete plant contracts signed reached a peak in 1973, and declined gradually thereafter.[64] The decline during 1974–75 was attributable to a complex of problems caused by the stagflation in the West and to the lack of ability on the part of the Chinese to absorb additional technology imports. The further drop in 1976 was probably caused more by internal political turmoil than by all other factors combined, as the leadership could not agree on investment priorities for the Fifth 5-Year Plan.

All in all, however, the accumulated value of all complete plant contracts signed between 1972 and 1977 reached an estimated total of about $3 billion. These imports were concentrated in a few selected industries: steel, electric power, petroleum, petrochemicals, synthetic fiber, fertilizers, and aircraft (jet engine). The decision to import complete plants in these priority industries must have been based on a recognition by the policymakers that in this way the technological level of these industries could be enhanced more rapidly than through piecemeal imports of individual components.

China is likely to continue to resort to these forms of technology acquisition. Chinese officials have openly predicted that complete plant imports will rise markedly. Several high-level trade delegations have been roving the world, including one led by Foreign Trade Minister Li Chiang which visited plants in England and France. An 8-year trade agreement with Japan for the import of plant and equipment (valued at about $8 billion) in exchange for Chinese crude oil, coking coal, and steaming coal was signed in Peking in February 1978.

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[63] For a discussion of China's technology imports in the early 1970's, see Hans Heymann, Jr., "Acquisition and Diffusion of Technology in China," Joint Economic Committee, "China: A Reassessment of the Economy." pp. 678–729.

[64] Complete plant contracts were valued at $332 million in 1972. rose sharply to $1.2 billion in 1973, and declined to $831 million in 1974 and $364 million in 1975. The value dropped further to an estimated total of $185 million in 1976 and some $60 million in 1977. See Central Intelligence Agency, "People's Republic of China: International Trade Handbook" (October 1976): and "China: International Trade, 1976–77" (November 1977); and Hans Heymann, Jr., op. cit.

2. The Principle of Self-Reliance

While imported technologies may be of great importance in enhancing the rate of technological progress, and hence of overall economic growth, full realization of the potential gains requires the resolution of a number of difficult questions. These questions revolve around China's cherished principle of self-reliance, which is essentially a self-protective mechanism arising in large measure from economic backwardness. The mechanism, however, changes over time in response to changes in political and economic conditions. The concept of self-reliance, therefore, can best be understood in the context of Chinese economic development over the past 28 years.

In the 1950's when the Chinese economy was heavily dependent on the Soviet Union, self-reliance took the form of "relying mainly on our own efforts while making external assistance subsidiary." [65] It was felt that the creation of an independent and comprehensive industrial system would require, at least initially, substantial inputs of foreign technology and equipment. This, coupled with the lean-to-one-side policy, led to a rapid expansion of trade with the Soviet Union and Eastern Europe.

When the Sino-Soviet split began to surface in 1960, China had diplomatic relations with only a few industrial countries in the West. Self-reliance became more inward-looking and narrower in scope. In a sense, it was a case of making virtue out of necessity. The slogan at that time was, "maintaining independence, keeping the initiative in our own hands and relying on ourselves." The accent was on becoming as self-sufficient as possible in various fields of production. During the 1960's China's foreign trade was reoriented toward the West. But for the decade as a whole there was virtually no growth in total trade.

In the early 1970's when the Chinese economy grew rapidly, China's diplomatic and trade relations, particularly with major Western countries, became more open and expansionary. As noted above, there was a dramatic rise in plant imports from the West and in the number of countries holding industrial exhibitions in China. The concept of self-reliance was more liberally interpreted. Teng Hsiao-ping, for example, told the United Nations General Assembly in April 1974, "self-reliance in no way means 'self-seclusion' and rejection of foreign aid." [66] Similar statements were made by China's leading trade officials.[67] Thus phrases such as "learning from other countries" and "making foreign things serve China," which were coined by Mao in the 1950's, were once again widely used in the Chinese media.

At about the same time, a number of articles expressed concern over the possibility of over-reliance on imports.[68] Although the gist of the discussion was highly ideological in nature, it may have been triggered by the desire of radical leadership groups to cut down plant and equipment imports. After the proposals in the "20 Articles" to further relax self-reliance became known in the latter half of 1975, the discussion in the radical-controlled media gradually developed into a campaign to discredit Teng, accusing him of, among other things, having practiced the "slavish comprador philosophy." [69] In fact, no political faction in China has denied the usefulness of technology and equipment imports; not even Teng's fiercest critics showed strong animosity toward such imports. At issue was the degree of reliance on imports and the manner of their financing.[70] These problems will continue to confront the newly realigned leadership in its formulation of economic and trade policies.

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[65] This was an instruction issued by Mao for the drafting of the Second 5-year plan.

[66] Peking Review, No. 16, Apr. 19, 1974, pp. 9–10.

[67] See Li Chiang, "The Development in China's Foreign Trade," China's Foreign Trade, No. 1, 1974, pp. 1–5; and Wang Yao-ting, "China's Foreign Trade, "Peking Review, No. 41, Oct. 11, 1974, pp. 18–20, 16.

[68] See, for example, Wei Pin-kuei, "Persist in the Principle of Maintaining Independence and Keeping the Initiative in Our Own Hands on Achieving Regeneration," Red Flag, No. 1, Jan. 1, 1974, pp. 85–88; Yueh Heng, "Fully Inspire the Socialist Positive Character of the Masses," ibid. No. 2, Feb. 1, 1974, pp. 63–68; and two articles in the People's Daily, Mar. 22, 1974.

3. The Policy of "Yang Wei Chung Yung" ("Making Foreign Things Serve China")

Current ideological expostulation with respect to technology imports holds that "advanced techniques and experience are the common wealth of the working people throughout the world," [71] and that "every country as it develops is bound to absorb and make use of, to a greater or lesser degree, scientific and technological achievements of other countries." [72] To avoid technological dependence on any given country, China will try to diversify, to the extent possible, sources of supply and will be highly selective in its choice of suppliers. Imports will be made in a discriminating manner, and only those plants, products, and techniques which will make China less dependent on external suppliers will be imported.[73] While economic and technical exchanges are deemed helpful to the enhancement of China's self-reliance posture, foreign investment and joint ventures still will be excluded.[74]

One important issue regarding technology imports concerns their impact on indigenous production and technological capabilities. China has accumulated a considerable stock of human technical skills since the founding of the People's Republic, especially since the pursuit of the policy of import minimization and "learning by doing" in the 1960's. With the substantial shrinkage of foreign inputs, Chinese industrial enterprises were forced to pioneer and propagate new techniques of their own invention. This has led to a great deal of indigenous innovation and a fairly rapid internal diffusion of existing production techniques. These developments, coupled with a rapid expansion of rural small-scale industries, have enabled China to gradually establish a substantial, indigenous technological base which should provide significant potential for industrial growth in the future. The problem confronting the Chinese leadership is to assure the continued development of such a technological base without being retarded by the importation of a large quantity of advanced machines.

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[69] See, for example, Fang Hai, "Criticize the Slavish Comprador Philosophy," Red Flag, No. 4, April 1976, pp. 21–26; Kao Lu and Chang Ko, "Comment on the Comparador-Burgeois Economic Thought of Teng Hsiao-ping," ibid, No. 7, July 1, 1976, pp. 25–30; "Selected Comments on "Certain Problems of Accelerating Industrial Development'," Study and Criticism, No. 4, Apr. 14, 1976; and Kung Hsiao-wen, "Teng Hsiao-ping and the '20 Articles'," ibid, No. 6, June 14, 1976.

[70] Although the "gang of four" was alleged to have disrupted foreign trade, even going so far as to dismantle the imported fertilizer equipment installed at the Taching oilfield, the articles by radical writers published at the height of anti-Teng campaign raised no objection to technology imports. One typical criticism was: "Our difference in principle with Teng Hsiao-ping lies not in whether or not it is necessary to learn and explore the experience of other countries, nor in whether or not it is necessary to bring in from other countries certain technology and equipment which are really useful to China, but in whether we should * * * shift our foothold to reliance on the introduction of foreign technology equipment and capital for the development of our economy as advocated by Teng Hsiao-ping." (The worker-peasant-soldier students of the 1973 Class of Economics Department of Peking University, "Teng Hsiao-ping and the Comprador-Bourgeoisie of Old China," in Kuang-ming Daily, July 27, 1976; translated in American Consulate General in Hong Kong, Survey of People's Republic of China Press, No. 6153, Aug. 9, 1976, pp. 1–6.)

[71] FBIS, Jan. 3, 1978, p. E16.

[72] Lo Yuan-cheng, "Self-Reliance and Making Foreign Things Serve China," Peking Review, No. 28, July 8, 1977, pp. 9–11; quotation on p. 10.

[73] See FBIS, Nov. 22, 1976, pp. E11–13; and Nov. 23, 1976, pp. E9–12.

[74] Although this appears to be the official policy at the present time, some modifications may be expected in the future when China becomes more flexible in its approach to foreign trade.

The current leadership seems to hold the view that the introduction of foreign technology will not be inimical to the development of indigenous innovation if a correct policy is followed. Teng Hsiao-ping once said, "To import (advanced technology and equipment) is for the purpose of learning from them and promoting our own inventions instead of using them to replace our own (technology)."[75] Therefore foreign technology should not be transplanted in China *in toto* without considering local adaptability. The advanced techniques and experience of foreign countries should be applied "analytically and critically" according to the principle of "First, use; second, criticize; third, convert; and fourth, create." [76] This means that in the course of applying foreign technology, Chinese technicians and engineers should try to learn and absorb it if it suits Chinese conditions and benefits China, but criticize and modify it if it is not adaptable to China. Further, they are urged to "Devise something original, and combine the assimilation of foreign experience with creations of (their) own so as to improve upon it and raise it to a higher level." [77] In this way, it is believed, foreign technology can be incorporated into and hence will reinforce the domestic technological base.

To staff the complete plants imported in recent years, China has to acquire many thousands of production engineers, technicians, supervisory personnel, and skilled workers. To select, adapt, disseminate, and develop a new increment of foreign technology in the manner outlined above would require additional high-grade technical manpower to undertake adaptative and developmental research. The limited supply of high echelon scientific, engineering, and managerial personnel is bound to restrict China's capability to expand plant and technology imports.

4. Financing Technology and Equipment Imports

Another major factor determining the level of plant and technology imports will be China's ability to finance them, which will depend on the import demand for grain and other agricultural products, the size of foreign exchange earnings, and a willingness to accept credit and other trade arrangements. China's agricultural import requirements are strongly influenced by the size of the harvest. The effect of agricultural imports on China's ability to pay for technology acquisition may be dramatically illustrated by the fact that since 1972, the value of grain imports alone has far exceeded that of complete plant imports.[78] The contrast was particularly marked for 1977, the first full year of the post-Mao leadership, when mediocre harvests led China to escalate grain and other agricultural imports to an estimated total of $1.5 billion, while in spite of an increased interest in foreign technology the value of complete plant contracts amounted to only some $60 million.

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[75] The China Business Review, vol. 4, No. 5, September-October 1977.

[76] This principle is said to have been initiated by the late Chou En-lai. See the Criticism Group of the China Committee for the Promotion of International Trade, "Redress the Crimes of the 'Gang of Four,' Develop Socialist Foreign Trade," People's Daily, Jan. 2, 1977, p. 3; and the Criticism Group of the Second Academy of Design of the Ministry of Light Industry, "Refute the Erroneous Theory of the 'Gang of Four' Concerning the Problem of Technological Imports," People's Daily, July 3, 1977, p. 3.

[77] FBIS, Nov. 23, 1976, p. E11; see also Hua's report to the Fifth NPC.

[78] During 1972–77 the value of grain imports amounted to $4.065 billion, compared to a value of some $3 billion for the complete plant contracts signed during the same period. (Central Intelligence Agency, "China: International Trade, 1976–77" pp. 16, 18.)

Provided that China will succeed in agricultural development to the extent that agricultural imports can be minimized, the level of plant and technology imports will be determined mainly by the size of foreign exchange earnings. The most important source of such earnings is exports. Export income may be augmented substantially if China is willing to relax self-reliance and step up export promotion. In this regard, at least four product areas have good potential, the most important probably being industrial raw materials including the much-publicized crude oil and, to a lesser extent, coal. Hua said in early 1978, "We should build a number of bases for supplying industrial and mineral products—for export," [79] China has set a goal of creating by the end of the century more than 10 oilfields equivalent to the size of the Taching Oilfield, which currently produces some 50 million tons of crude oil a year.[80] Whether the goal can be met within the specific time frame is difficult to assess at this time.[81] But there is no doubt that the energy sector has received top priority in the allocation of resources. Chinese economic planners apparently hope to transform crude oil and coal into major foreign exchange earners. This has been evidenced by the Sino-Japanese long term trade agreement and by the negotiations now underway for the sale of Chinese oil and coal to other countries.

A second area is labor-intensive industrial products. The development of labor-intensive export industries could provide China a major mechanism for converting its abundant labor resources into foreign exchange earnings. The potential benefit is attested to by the export-led growth experience of labor-surplus economies. China now seems ready to follow this route at least partially. The Minister of Foreign Trade in a recent article made it clear that China would establish a number of so-called "export commodity production bases" (ch'u-k'ou shang-p'in chi-ti) and set up "specialized" factories and "fixed production points" (ting-tien sheng-ch'an) to manufacture goods solely for export.[82]

For much the same reasons, a number of labor-intensive agricultural products could be developed along the lines dictated by comparative advantage. China is already a major rice exporting country, selling 1 to 2 million tons of rice a year. Communes now are urged to step up and diversify sideline production activities to "serve exports." [83] A number of "export bases" for agricultural and sideline products will be built.[84] Increased production of such cash drops as mushrooms, asparagus, pineapples, and bananas could provide additional sources of foreign exchange earnings.

Finally, there is still room for expanding the market for a wide variety of China's traditional export commodities. The shortage in the supply of many such commodities was evident at the last few Canton Fairs. But China will have to give sufficient attention to design, quality standards, labeling, styles, and packaging.

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[79] Hua's Report to the Fifth NPC.

[80] See Yu Chiu-li's report at the National Industrial Conference on May 4, 1977 (*People's Daily*, May 8, 1977, pp. 1-3).

[81] Vice Minister of the Petroleum and Chemical Industry Sun Ching-wen is reported to have said in February 1978 during his visit to Tokyo that China has selected fifteen locations to develop them into large oilfields, each having annual production capacity of at least 20 million tons of crude oil. (*Ta-Kung Pao*, February 3, 1978, p. 1).

[82] Li Chiang, "Distinguish Between the Right and Wrong in the Line and Actively Develop Socialist Foreign Trade," Red Flag, No. 10, October 10, 1977, pp. 31-38.

[83] People's Daily, Jan. 16, 1978, p. 1.

[84] Hua's report to the Fifth NPC.

A number of factors, however, will have to be considered by Chinese policymakers in planning export growth. Considerable amounts of human and material resources will have to be diverted to the development of export industries, especially oil and coal. For these two products, moderate increases in exports will require substantial investment in production, transportation, and harbor facilities. Domestic demand for these products may greatly restrict export possibilities. Large energy requirements for the four-modernizations program will make the long-term prospect for the exportable surplus of both oil and coal extremely uncertain.

Further, an enlarged export sector may expose the Chinese economy to the demand and price fluctuations on the world market. It may also cause strong competition from other suppliers and protectionist measures adopted by importing countries.

Another source of foreign exchange earnings, which is much less important than export income but nontheless may have good future potential, lies in invisibles such as overseas Chinese remittances, tourism, and Chinese business activities in Hong Kong. Overseas remittances have been traditionally an important source of China's foreign exchange earnings. In the 1950's and 1960's, these remittances more than offset the trade deficit, contributing significantly to China's foreign exchange reserve. Because of substantially expanded imports, the deficit in the first half of the 1970's was several times as large as in the 1950's and 1960's. Yet overseas remittances were still able to cover half of the adverse trade balance.[85] Renewed emphasis on overseas affairs reflected in recent policy statements seems to be designed in part to attract overseas remittances.[86] But their relative importance in China's total international receipts is not likely to increase in the long run mainly because the tie between the overseas Chinese and their relatives on the mainland tends to become weaker over time.

On the other hand, both tourism and business activities in Hong Kong may gain in relative importance in the future. Tourism can generate very substantial hard currency earnings without significant capital investment. In the past, China has not been willing or able to open the country to large numbers of tourists. But last year saw the beginning of a significant shift in the policy toward tourism. Tourists on world cruise ships were allowed to stop in China for sightseeing, and Pan American World Airways conducted the first organized airline tour for American tourists to visit Peking, Shanghai, Hanchow, and Canton Then, a January 1978 article in China Reconstructs stated, " * * * Thousands of applicants (for tourists visa) have been disappointed China regrets this but is expanding services and facilities as rapidly as possible to meet the demand " In early 1978, a national work conference on tourism was held in Peking. It decided to "build more tourist centers and conduct special tours to scenic spots to accommodate the increasing number of foreign tourists." [87]

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[85] Nai-Ruenn Chen, "China's Balance of Payments: The Experience of Financing a Long-Term Trade Deficit in the Twentieth Century," a paper presented at the Conference on Modern Chinese Economic History, Taipei, Taiwan, Aug. 26-29, 1977.

[86] See, for example, Liao Cheng-chih, "Criticize the Reactionery, Erroneous Theory of the 'Gang of Four' Concerning the So-Called 'Overseas-Relation' Problem,"; and Editorial, "Must Pay Great Attention to Overseas Affairs," both in People's Daily, Jan. 4, 1978, pp. 1, 3.

The decision to develop tourism coincided with that to ease restrictions on overseas Chinese and foreign nationals of Chinese descent to visit China. These decisions indicate that China is beginning to edge into tourism as a source of foreign exchange. To gain some idea as to the size of foreign exchange earnings that would be generated by tourism, one needs only to look at the experience of Taiwan. In 1977, Taiwan attracted over 1.1 million tourists who spent over half a billion U.S. dollars there.[88] The number of tourists is expected to increase to 1.5 million by 1980. If China, whose area is more than 264 times that of Taiwan, were to actively promote tourism, its earnings potential could be enormous.

Hong Kong plays a unique role in China's international economic development. It is China's largest export market absorbing over 20 percent of Chinese sales abroad. In addition to providing facilities for transmitting to China a large part of overseas remittances and receipts from travelers, Hong Kong provides increasing amounts of foreign exchange income from profits of PRC-controlled banks, insurance companies, shipping agencies, retail outlets, and real estate holdings. In recent years China has made a growing number of new investments in Hong Kong.[89] In the course of China's international economic expansion, the role of Hong Kong is likely to become even more important. A recent authoritative article on China's foreign trade policy called for further expanding exports to Hong Kong.[90] Negotiations are underway for China to supply up to 3.5 million tons of coal annually to a new large power generating plant to be built in Hong Kong.[91]

China's ability to import advanced technology and equipment, however, does not depend solely on current foreign exchange earnings, since imports also may be financed by credits or other commercial practices, including countertrade. To help pay for imports, China in recent years has made limited use of commercial credit. Short-term credit has been used to purchase foreign goods, 5-year credit in the form of the so-called deferred payment has been adopted to buy complete plants, and interbank deposits at market interest rates have been accepted.

China has avoided using long-term credits because of the adverse experience associated with the Soviet loans in the 1950's. But Chinese planners recognize the very high economic benefit of long-term borrowings from abroad. Some high Chinese officials have raised the possibility of seeking 8- or 12-year credits. Hua also pointed out that it was desirable to "handle * * * business transactions flexibly." [92]

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[87] FBIS, Feb. 3, 1978, pp. E1–E2.

[88] The World Journal, New York, Feb. 17, 1978, p. 11.

[89] A machinery plant, oil storage facilities, and a ship repair yard have been built in Hong Kong with Chinese capital. A $15 milion expansion of a Chinese retail outlet in Hong Kong had been completed in December 1977.

[90] Li Chiang, op. cit.

[91] Ta Kung Pao, Jan. 26, 1978, p. 4.

[92] Hua's report to the Fifth NPC.

When the Chinese become confident that their export earnings and other foreign exchange incomes will greatly augment China's financial capability, their aversion to long-term credits is likely to ease.

China's ability to finance imports could be increased greatly through countertrade, a practice increasingly used in East-West trade. In countertrade transactions, an Eastern import of plant, equipment, or technology from the West is financed by an offsetting Western purchase of Eastern products.[93] In China, a similar technique was proposed in the "20 Articles." Teng Hsiao-ping is said to have initiated the idea of importing plants and equipment from the West for the development of the oil and coal industries, and then paying for these imports with resultant products.[94] The long-term trade agreement which China has reached with Japan seems to reflect this idea in general. There are indications that Peking is actively considering the possibility of using buy-back compensation schemes for complete imports and accepting foreign raw materials and component parts for further processing or assembly and then reexport.

VI. Prospects for the Future

1. *Constraints Influencing Economic Modernization*

China's economic modernization efforts may be influenced by a number of constraining factors. The speed of economic growth during the balance of the century will depend largely on the ability to remove or minimize the impact of these constraints. Some of them are ideological, political, or institutional in nature while others represent bottlenecks in the economy.

On the ideological front, although the post-Mao leadership has shown flexibility in interpreting the self-reliance principle, changes are likely to be gradual and slow. Further, certain basic tenets are expected to remain inflexible. As long as the preclusion of foreign direct investment in China continues to be one of these tenets, China deprives itself of the benefit that, as the experience of many developing countries has shown, foreign capital could contribute to economic modernization. But a much broader ideological constraint lies in the likelihood of a recurrence of the "two-line struggle." The development of China's economy under Mao showed a deep-seated conflict between ideology and the economic and technical realities of the country, leading to a cyclical pattern of economic growth.[95] The Hua government has launched an intense rectification campaign to purge the followers of the "gang of four" at all levels in an attempt to alleviate such a conflict.[96] But it remains to be seen if economic success in the post-Mao era can continue for a prolonged period of time without giving rise to a group of "neo-radicals" to seriously challenge the pragmatic leadership and/or its economic policies.

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[93] For a discussion of countertrade practices in East-West trade See JeNelle Matheson, Paul McCarthy, and Steven Flanders, "Countertrade Practices in Eastern Europe," in Joint Economic Committee, "East European Economies Post-Helsinki," Washington, D C., 1977.

[94] "Selected Comments—" "Study and Criticism," April 1976: and Kao Lu and Chang Ko.

[95] For a discussion of the effect of such a conflict on the Chinese economy under Mao, see Alexander Eckstein, "China's Economic Development: The Interplay of Scarcity and Ideology," Ann Arbor, Mich., 1975, particularly chap. 11, "Economic Fluctuations in Communist China's Domestic Development," pp. 300–338.

[96] Hua told the Fifth NPC in February 1978, "The primary task for the people of our country at present and for some time to come is still to expose and criticize the 'gang of four' and carry this great struggle through to the end." (Hua's Report to the Fifth NPC.)

The failure to stave off such a challenge could greatly jeopardize the political stability which would be absolutely essential to the success of China's modernization efforts. In the short run, political stability also depends on the cohesiveness of the various elements that have made up the post-Mao leadership. Recent political events in Peking, including major decisions and appointments approved by the Fifth NPC, have provided an appearance of political unity and stability. Yet differing factional interests still exist. In the next few years, unity and stability will require a durable, cohesive coalition of all leadership elements.

The current drive to improve efficiency is aimed at certain facets of economic operations in which output could be raised through better utilization of the existing resources. But certain types of economic inefficiency are found deep rooted in socialism and socialist institutions themselves. The socialist systems of centralized control over resource allocation, price formation, success criteria, and a host of other procedures in economic decisionmaking are designed to assure resource use in conformity with planners' preferences rather than with an economic optimality.[97] The resultant inefficiency, therefore, cannot be removed without fundamental reforms.

Economically, as indicated above, the greatest bottleneck lies in the agricultural sector. The success of the four-modernizations program will hinge critically on the Chinese ability to expand agricultural output considerably faster than population growth. Since the early 1950's agricultural production in China, growing on the average at 2 to 3 percent a year, has merely kept pace with population increases. In spite of massive efforts to construct farmland capital projects, particularly in the past decade, China's agriculture is still vulnerable to changes in natural conditions. At the same time, birth control and late marriage, while beginning to show some effects on population growth especially in the cities, have a long way to go in reducing the overall rate of increase.

To finance the modernization program and allow for a moderate increase in the standard of living, China now has set up a rather ambitious plan to lower the rate of population growth to below 1 percent within 3 years and step up the rate of agricultural growth to 4 to 5 percent in each of the 8 years from 1978 to 1985.[98] To achieve these targets will be extremely difficult, if not impossible. Without very favorable weather conditions and major technological breakthroughs, it will be highly unlikely that China can obtain the annual rates of increase targeted for agricultural production.

Certain other economic sectors, particularly electric power and transport, have developed into major bottlenecks brought about by years of relative neglect in investment allocation. The slow progress of these two sectors, considered as "vanguards" in the Chinese economy,[99] is likely to constrain China's industrial growth in the immediate years ahead. To assure rapid industrial expansion in the 1980's will require power and transport to grow more rapidly than industry as a whole.[1]

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[97] For a discussion of economic inefficiency under socialism, see Abram Bergson, "The Economics of Soviet Planning", New Haven: Yale University Press, 1964, especially chap. 14; and Joseph Berliner, "The Innovation Decision in Soviet Industry," Cambridge: MIT Press, 1976.

[98] Hua's Report to the Fifth NPC.

[99] SPC, "The Great Guideline for Socialist Construction," People's Daily, Sept. 12, 1977, pp. 1, 2, 4.

The shortage of technical manpower will also become a major constraint. The extent to which it will inhibit industrial growth depends on how fast the loss of half a generation in education and basic research will be recovered and on how effective the new educational system will be in turning out sufficient numbers of advanced engineers and scientists.

Between 1952 and 1977 the rate of industrial growth in China averaged about 10 percent a year. China will have to stay at least at this rate to attain its stated goal of accelerating economic progress. Depending on the degree of success that China may have in reducing economic inefficiencies and in enhancing technological progress, industrial growth during 1978–85 could proceed at an annual rate of over 10 percent. In view of the various constraints enumerated above, sustained industrial growth at a rate higher than 12 percent a year seems unlikely. As the industrial production base grows over time, however, it will become increasingly difficult to sustain these high rates of growth during 1986–2000.

2. China's Projected Relative Economic Position

To gain some idea as to China's future economic position relative to the major industrial countries, an attempt is made here to project China's gross national product (GNP) to 1985 and 2000 and compare it with the projected GNP's for the United States, the Soviet Union, Japan, and the countries of the European Economic Community as a whole. Bearing in mind that the GNP estimates for China are subject to a considerable margin of error and that an international comparison of GNP's is fraught with problems and difficulties, the projection provides orders of magnitude with respect to probable changes in China's future economic capabilities relative to the other major powers. The projected estimates for the major industrial countries were made on the assumtpion that their GNP's during 1977–2000 would grow at rates somewhat lower than those attained during 1960–76. As a latecomer in modern economic development, however, China's GNP in the balance of the century can be expected to rise faster than in the past, provided that the country succeeds in implementing its modernization program. But as development proceeds, the rate of growth is likely to gradually slow down.

Assuming the 10-year economic plan (1976–85) will see average annual rates of growth before 1985 in the probable ranges of 3 to 4.5 percent for agricultural production and 10 to 12 peecent for industrial production and assuming further the resultant GNP growth rates would range from 6.5 to 8.5 percent a year,[2] compared to an annual rate of 6 percent during 1952–76,[3] the projected GNP for China in 1985 will lie between 570 and 675 billions of constant 1976 U.S.

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[1] Clarke's study of China's electric power industry shows that the ratio of the growth rate of the electric power industry to that of the industry as a whole was 1.6 during the period 1952–75, but declined to 1.3 during 1971–85. He projects the ratio at 1.3 for the period 1977–85. See Clarke's paper in this volume.

[2] This range was derived on the assumption that during 1976–85 the average annual growth rates would be 3 to 4.5 percent for agriculture, 10 to 12 percent for industry, and 5 to 7 percent for the service sector, and that in 1975 agriculture contributed 37 percent to China's GNP, industry, 38 percent and services, 25 percent. The estimates of various sectors' contribution to GNP were based on Robert F. Dernberger, "The Economic Consequences of Defense Expenditure Choice in China," in Joint Economic Committee, China: A Reassessment of the Economy, 1975, pp. 467–499.

[3] National Foreign Assessment Center, China: Economic Indicators, Washington, D.C., Oct. 1977, p. 3.

dollars. For the period 1986–2000, the probable ranges fo annual growth rates are assumed to decline to 2.5 to 4 percent for agriculture and 8 to 10 percent for industry, resulting in a range of GNP growth rates from 6 to 7.8 percent a year.[4] China's GNP in the year 2000 is thus projected at a level between 1,367 and 2,094 billions of constant 1976 U.S. dollars. These ranges of estimates for 1985 and 2000 represent reasonable expectations of what GNP levels could be achieved through the modernization effort. The attainment of levels significantly below the lower estimates would indicate the failure of the four-modernizations program to reach its stated economic goal. On the other hand, the probability of achieving levels considerably above the higher estimates will be small without very major ideological modifications, institutional reforms and technological breakthroughs.

TABLE 1.—DISTRIBUTION OF GROSS NATIONAL PRODUCTS OF 5 MAJOR POWERS, 1976, 1985, AND 2000

[In percent]

		1985		2000	
	1976	Projection I	Projection II	Projection I	Projection II
United States	34.8	31.9	31.5	27.1	25.8
European Economic Community	28.3	27.2	26.8	24.9	23.7
U.S.S.R	18.9	19.0	18.7	18.7	17.8
Japan	11.3	14.0	13.8	19.7	18.7
China	6.7	7.9	9.2	9.6	14.0
Total	100.0	100.0	100.0	100.0	100.0

NOTES AND SOURCES

1976 GNP figures are based on Central Intelligence Agency, Handbook of Economic Statistics, 1977, Sept. 1977, p. 31. Average annual growth rates of GNP for both 1977–85 and 1986–2000 are assumed to be 3.5 percent for the United States, 4 percent for the European Economic Community, 4.5 percent for the U.S.S.R., and 7 percent for Japan.

China's GNP is projected on the basis of two different ranges of growth rates for 1977–85 and 1986–2000. Projection I which gives the lower end of the estimates assumes an average annual growth rate of 6.5 percent for 1977–85 and 6 percent for 1986–2000. Projection II which shows the higher end of the estimates is based on an average annual growth rate of 8.5 percent for 1977–85 and 7.8 percent for 1986–2000. The rationale for the selection of these growth rates and the resulting range of GNP estimates for 1985 and 2000 are explained in the text and in footnotes 2 and 4.

The above table shows the GNP distribution of the five major powers in 1976 and the distribution projected for 1985 and 2000 according to the assumptions made above. In 1976, the five major powers combined accounted for about 70 percent of the world's GNP. Of these five major powers' total GNP, China's share in 1976 was only 6.7 percent; it produced less than one-fifth of the level of the world's largest producer, the United States, and some 60 percent of the level of fourth largest, Japan. A successful modernization drive in China could increase its share to 8 to 9 percent by 1985 and 10 to 14 percent by the year 2000. With the most optimistic estimate, China's GNP would still rank last among the five major powers by the end of the century, but could reach over half of the U.S. level and more than 70 percent of the Japanese or Soviet level.[5]

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[4] On the basis of the estimates of various sectors' contribution to GNP in 1975 and the growth rates assumed for these sectors during 1976–85, as explained in footnote 2, the distribution of GNP among the three main sectors in 1985 can be estimated as 28 percent for agriculture, 49 percent for industry and 23 percent for services. Assuming that during 1986–2000, the range of annual growth rates are 2.5 to 4 percent for agriculture, 8 to 10 percent for industry, and 4 to 6 percent for the service sector, the average annual growth rates of GNP can be derived in the range from a low of 6 percent to a high of 7.8 percent.

[5] It should be noted that in terms of GNP per capita China is not a world power, and in all probability will not become a power by the end century. In 1976, GNP per capita in China was only $340, while the figure was $7,860 for the United States, $5,330 for the European Economic Community, $3,590 for the Soviet Union, and $4,880 for Japan. (Central Intelligence Agency, Handbook of Economic Statistics, 1977, pp. 18–19.) Even with the most optimistic assumption that the annual rate of population growth will be reduced to 1 percent within 3 years, as planned, and will remain at this rate in the balance of the century, and that GNP by the year 2000 will reach the higher end of the range estimates, China's GNP per capita by the end of the century will come to only $1,735, a level comparable to the figure for Iran, Hong Kong, and Mexico in 1976.

CHINA: SHIFT OF ECONOMIC GEARS IN MID-1970's

By Arthur G. Ashbrook, Jr.

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I. Key Findings

1. For much of 1975–77—the 3 years since the publication of the last Joint Economic Committee volume—the economy of the People's Republic of China moved ahead erratically without firm commands from the center. A fierce power struggle over the succession to Chairman Mao Tse-tung precluded unified economic policy guidance.

2. After Mao's death on September 9, 1976, the new governing faction under Hua Kuo-feng moved swiftly to arrest its chief radical opponents, the Gang of Four, and to begin the process of "restoring great order across the land." The Fifth National People's Congress, convened in late February 1978, approved an ambitious 10-year economic plan (1976–85) to accelerate the modernization of China's Marxist-Leninist society.

3. Economic damage from the political turbulence of recent years, while serious, was less than the losses suffered during the 1967–68 peak of the Cultural Revolution and far less than the losses of the Great Leap Forward (1958–60). As the Soviet-style economic system has taken root, political upheavals have had less and less impact on the daily workings of the economy and its growth patterns.

4. Direct economic damage in 1975–77 mainly took the form of sizable losses in potential industrial output, due to transportation tieups, shortages of coal and steel, and failures of economic administrators in coordinating inputs with outputs. Other, less direct, damage

stemmed from a lowering of factory discipline, fear of managers to take initiatives, failure to exploit available domestic and foreign technology, the protracted standdown in higher education, and the general irresolution in central economic policy.

5. Even though growth in industry, agriculture, and foreign trade was stunted in the 3-year period, important additions were being made to capital plant. Several big petrochemical plants and other modern industrial facilities were commissioned; major water control and land reclamation projects were pushed forward; and the rail and road networks were upgraded and extended into new areas. Investment amounted to a healthy one-quarter of gross national product.

6. Similarly, despite prolonged disputes over how to reestablish the higher education system, human capital was accumulating on a broad front. Primary and secondary schooling expanded, and millions of Chinese workers increased their on-the-job mastery of modern industrial and agricultural methods.

7. Behind the political turbulence, most households experienced small improvements in living standards, through the growth in the number of higher paying jobs, the greatly increased stock of consumer durables in household use, the self-help improvement of rural housing, and the continued grudging permission for private plots, handicrafts, and trade.

8. While remaining well below the 1970–71 peak, the production and procurement of military hardware rose gradually in 1975–77, and the modernization of the armed forces proceeded at a deliberate pace.

9. The population control program, which is being successfully extended further into the countryside, has helped bring the national population growth rate below the 2.3–2.4 percent rates of 1967–71, with rates under 1.5 percent in prospect by 1985. The program has begun to have substantial impact because its goals are consistent with most of the modernizing trends in Chinese society, for example, improvements in health care, education, benefits for the elderly, and opportunities for women.

10. The post-1960 blackout on economic statistics was partially lifted in early 1978, when several specific national economic targets for 1985 were announced. Otherwise, the planning and statistical organs over the last 3 years continued to release only scattered percentage figures, which implicitly confirm the tentativeness of economic planning and the spottiness of economic results.

11. In addressing the problems of economic modernization, the fledgling Hua government already has stiffened labor discipline, raised the wages of urban workers in the lower grades, begun to restore educational standards, and encouraged the wider import of foreign technology. Vice-Premier Teng Hsiao-ping—brought back from political banishment for the second time, as the de facto executive officer of the PRC—has sparkplugged this revived emphasis on hard work, increased output, and industrial expertise.

12. In the period 1978–80, the goverment expects to break bottlenecks in steel and coal production, move aggregate output closer to the economy's capacity, and further make up for recent neglect of science and technology.

13. By the year 2000, the government hopes to honor the late Premier Chou En-lai's call for the "four modernizations"—of agriculture, industry, national defense, and science and technology.

14. The economic plans and economic events of the next two decades will have a different flavor because of the absence of Mao. As the father figure of the revolutionary government, he had the strength to push the economy in entirely new and unexpected directions. His successors will of necessity have to steer a steadier course.

15. The PRC economy almost certainly will continue to stand out among the world's lesser developed economies in (a) its successful mobilization of rural manpower for land improvement and small-scale industrialization, (b) its concomitant success in controlling rural-to-urban migration, which in other less developed countries (LDC's) has resulted in massive unemployment, widespread crime, and abysmally low living conditions; (c) its avoidance of large-scale foreign debt, with the accompanying financial burdens and loss in financial and political independence; (d) its ability to design modern weapons and to supply the needs of its armed forces from domestic production facilities; and (e) its development of a highly promising system for bringing population growth down toward zero.

16. At the same time, economic growth rates probably will drift downward in the 1980's, after the catchup gains in prospect for 1978–80. Growth could be quite respectable by international standards, yet still below the long-term PRC rates of 5½ percent for gross national product and 9 percent for industry.

17. Factors reining in Chinese growth rates include (a) the inability to further expand the effective supply of arable land, (b) the using up of the massive reserves of unemployed and underemployed labor, and (c) the general inefficiency of socialist command economies in dealing with increasingly complex product mixes.

18. The People's Republic almost certainly will continue to widen its margin over most countries of the Third World, while failing to narrow the gap with the leading industrial nations in industrial and military technology, per capita output, and living standards.

19. Finally, China under the Communists has scored signal successes in providing for basic economic wants and creating a mechanism for economic growth. For the foreseeable future, however, the system is not likely to provide the rank-and-file Chinese with a free choice of job, residence, consumer goods, or leisure time activities.

TABLE 1.—CHINA: ECONOMIC RESULTS, 1949–77

Period	Overall results	Industrial results	Agricultural results	Foreign trade results	Consumer welfare results
1949–52: Rehabilitation	Return to pre-Communist level of economic activity through imposition of economic "law and order."	Reactivation of idle capacity as flow of raw materials resumes.	Return of idle fields to operation, elimination of landlord-gentry class, and distribution of land to peasants.	Imposition of strict government control and switch to Communist trading partners.	End of civil war, inflation, gross starvation; rekindling of hope; establishment of ration system.
1953–57: 1st 5-yr plan	Successful buildup of industrial base under Soviet-style plan and with Soviet aid.	Increased capacity and output of steel, coal, cement, electric power, simple machinery.	Gains in output from resources already in sector; collectivization in stages.	Growing volume, with basic products being exchanged for Soviet machinery.	Stabilization of living standards at spartan but improved levels; tying of individual to job.
1958–60: Great Leap Forward	Disastrous overstraining of economy's resources in attempt to double tempo of industrialization; end of Soviet aid.	Ruinous increase in factory quotas and workpace, with rapid deterioration in quality.	Precipitous fall in output due to bad weather, the ill-fated communes, and impractical policies of center.	Sharp spurt, then downturn caused by domestic problems.	Near starvation and collapse of morale when Leap fails; dissension among army rank and file.
1961–65: Readjustment and recovery	Quick-footed recovery of economic balance by retreat from Leap Forward policies.	Rationalization of output, with investment focused on oil, electronics, and agricultural-support branches.	Quick return to growth pattern, with key policy change providing massive inputs from industry.	Dramatic shift to Japan and Western Europe as suppliers of machinery and industrial raw materials; grain imports.	Restoration of living standards at spartan levels; ban lifted on private plots.
1966–70: Cultural revolution and 1970	Short-lived break in economic momentum due to political turmoil; damage to urban economy only.	Sharp dip in industrial output, 1967–68; continued gains in capacity.	Continued growth on basis of generally good weather and ever-mounting inputs.	Temporary dip because of domestic dislocations in planning and production.	General maintenance of living standards despite political turmoil; private plots undisturbed.
1971–75; 4th 5-yr plan	Resumption of economic growth except for politically related interruptions, especially in 1974.	Gains in capacity and output; oil a star performer, coal and steel lagging, factory disorders, 1974–75.	Continued growth on basis of generally good weather and evermounting inputs.	Resumption of growth in line with domestic gains; cautious use of credit.	Gradual improvements in diet, clothing, housing, durables, health, working conditions; wage grumbles; population control program.
1976–85: 10-yr plan (entries cover 1976–77)	Turmoil attendant on death of Mao and Chou; attempt to restore orderly growth.	Gains in capacity; output held back by factory disorders.	Further advances in mechanization, water control, and seed quality; output held back by weather.	Achievement of sizable trade surplus in 1977, laying ground for new upsurge in imports.	Slow advances for most households; wage increases; population growth on downtrend.

TABLE 2.—CHINA: MAJOR ECONOMIC INDICATORS, 1949–77[1]

	GNP (billions of 1977 dollars)	Population midyear (millions)	Population increase (percent)	GNP Per capita (1977 dollars)	Agricultural production (1957=100)	Grain output (millions of metric tons)	Grain output per capita (kilograms)	Industrial production (1957=100)	Steel output (millions of metric tons)	Percent trade with Communist countries
1949–52: Rehabilitation:										
1949	54	538	1.20	101	54	111	206	20	0.16	([2])
1950	67	547	1.35	122	64	130	237	27	.61	29
1951	78	558	1.51	139	72	141	253	38	.90	51
1952	92	570	1.80	162	84	161	283	48	1.35	70
1953–57: 1st 5-year plan:										
1953	98	583	2.25	168	84	164	282	61	1.77	68
1954	102	596	2.31	172	84	166	279	70	2.22	74
1955	112	610	2.39	183	94	180	295	73	2.85	74
1956	121	625	2.43	193	97	188	301	88	4.46	66
1957	128	640	2.36	201	100	191	298	100	5.35	64
1958–60: Great Leap Forward:										
1958	153	655	2.26	233	108	206	314	142	11.08	63
1959	145	670	2.14	217	83	171	255	173	13.35	69
1960	141	683	1.82	206	74	156	228	181	18.67	66
1961–65: Readjustment and recovery:										
1961	112	695	1.53	161	78	168	242	105	8	56
1962	124	707	2.01	176	89	180	255	111	8	53
1963	139	722	2.12	193	96	190	263	134	9	45
1964	157	737	2.17	212	102	194	263	161	10.8	34
1965	174	754	2.26	231	104	194	257	199	12.5	30
1966–70: Cultural revolution and 1970:										
1966	196	771	2.22	254	113	215	279	232	15	26
1967	188	789	2.30	238	118	225	285	202	12	21
1968	189	807	2.35	234	110	210	260	221	14	22
1969	210	827	2.39	254	113	215	260	266	16	20
1970	244	847	2.38	288	127	243	287	316	17.8	20
1971–75: 4th 5-yr plan:										
1971	261	867	2.31	301	130	246	284	349	21	23
1972	273	886	2.20	308	126	240	271	385	23	22
1973	308	906	2.10	340	142	266	294	436	25.5	17
1974	320	924	2.00	346	146	275	297	455	23.8	17
1975	342	943	1.98	362	148	284	301	502	26	16
1976–85: 10-yr plan:										
1976	342	962	1.98	355	148	285	296	502	23	18
1977	373	983	2.26	379	149	285	290	572	26	17

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[1] For details on the calculation of GNP and on the sources of data presented in this table, see app. A.

[2] Negligible.

II. Introduction: Organization of the Paper

This paper presents an up-to-date assessment of the achievements, failures, problems, and potential of the economy of the People's Republic of China (PRC). While parts of the paper deal with the whole course of economic development in China since the establishment of the Communist government in 1949, most of the discussion focuses on the 3 years (1975, 1976, and 1977) since the compiling of the last Joint Economic Committee volume on the Chinese economy.[1] These 3 years include the final year of the Fourth 5-Year Plan (1971–75) and the first 2 years of the newly announced 10-year plan, which has absorbed the Fifth 5-Year Plan (1976–80).

The paper begins with key findings, which are supplemented by basic facts and figures presented in two summary tables. Table 1 sets forth the economic results of each of the seven periods into which the economic history of the People's Republic may be logically divided.[2] Table 2 furnishes basic year-by-year statistical series for the economy, from the founding year 1949 through the year just past, 1977.

The body of the paper begins with a short description of three major political upheavals—the Great Leap Forward, the Cultural Revolution, and the Gang of Four affair [3]—and their damage to the economy. Next come sections on developments in 1975–77 in agriculture, industry, military industry, and foreign trade. Then come appraisals of living standards and the population control program. Finally, an outlook section deals with prospects for economic growth over the next few years and a few broad comparisons with other developing nations.

Appendix A describes how the primitive gross national product estimates used in this paper were updated. Appendix B gives a capsule appraisal of the sources of data on the Chinese economy.

In dealing with the unsuccessful bid of the Gang of Four for supreme party and state power, the term "militant ideologues" is employed for those Chinese leaders who on most issues value ideological purity more highly than productive efficiency, and the term "economic modernizers" for those who take the opposite approach.[4]

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[1] This is the fourth paper that the author has been privileged to contribute to the Joint Economic Committee compendiums on China. References to the three former papers are: (1) Arthur G. Ashbrook, Jr., "China: Economic Overview, 1975," "China: A Reassessment of the Economy," Joint Economic Committee of the U.S. Congress, Washington, 1975, pp. 20–51; the volume is cited hereafter as "JEC–75" and the paper as "Ashbrook, JEC–75"; (2) ———, "China: Economic Policy and Economic Results, 1949–71," "People's Republic of China: An Economic Assessment," Joint Economic Committee of the U.S. Congress, Washington, 1972, pp. 3–51; the volume is cited hereafter as "JEC–72" and the paper as "Ashbrook, JEC–72"; and (3) ______, "Main Lines of Chinese Communist Economic Policy," "An Economic Profile of Mainland China," Joint Economic Committee of the U.S. Congress, Washington, 1967, pp. 15–44.

[2] Table 1 is a revision of the table 1 in Ashbrook, JEC–75, p. 22. Among the changes is a slight recasting of the chronology. Whereas the former paper labeled the years 1970–74 as "Resumption of Regular Planning," the present paper (a) assigns the year 1970 to the prior 1966–69 period, which is renamed "Cultural Revolution and 1970"; (b) continues with the Fourth 5-Year Plan (1971–75); and (c) adds the "Ten-Year Plan (1976–85)", which was announced by Chairman Hua in early 1978 and which has absorbed—but not necessarily eliminated—the old Fifth 5-Year Plan (1976–80). The year 1970 stands as a transitional year, which follows the winding down of the Cultural Revolution and precedes the resumption of formal longer-run economic planning.

[3] The Gang of Four refers to the four top radicals, who were arrested in October 1976, and by extension to their followers, who in early 1978 are still being ferreted out by the Hua administration. The name, which was fixed on the radical faction only after the arrest of the leaders, is said to have been taken from an earlier warning by Chairman Mao to his wife Chiang Ching against factional activity—"Don't function as a gang of four." In addition to Chiang, the radical quartet included Wang Hung-wen, the youthful Shanghai labor leader who rocketed to the number three Party post during the Cultural Revolution; Chang Chun-chiao, vice-premier and long time leftist with roots in Shanghai; and Yao Wen-yuan, high-ranking editorialist and polemicist, also from Shanghai. Between the death of Mao and their arrest, they ranked among the six top leaders of the People's Republic, as follows: Wang, No. 2; Chang, No. 4; Chiang, No. 5; and Yao, No. 6. The Gang of Four was especially strong in the following parts of the PRC power structure: education, the press, the arts, the militia, and the city of Shanghai. Its strength was further increased by Chiang's position as the Chairman's wife.

This paper is based on information received through March 31, 1978.

III. THREE POLITICAL UPHEAVALS: DAMAGE ASSESSMENT

The interruptions to systematic economic growth in the People's Republic of China have stemmed less from crop failures, or construction cycles, or planning difficulties and more from conflicts at the top of the Communist hierarchy over political power and revolutionary goals. The focal point of these conflicts has been Chairman Mao Tse-tung, whose death on September 9, 1976, is the single most important event in the 3 years since the publication of the preceding Joint Economic Committee volume.

Among the many roles played by Mao were two that have been identified by Prof. Michel Oksenberg as being of central importance to economic policy and performance:[5] (a) Mao as the great arbiter of national policy disputes, standing above the conflict, nodding benignly first to one faction, then to the other; and (b) Mao as the inspiration and leader of a comparatively small, ideologically oriented group of Communist leaders who wished to promote—and head up—a much more thorough and rapid transformation of Chinese society. In opposition to this last-mentioned group of militant ideologues has stood a larger mainstream group of leaders, the economic modernizers.

This latter group must not be viewed as ideological backsliders. Rather they are hard-bitten survivors of old party struggles who have differed with the militants on the priorities in pushing ideological and economic measures, and who during the nearly three decades of PRC history have acquired substantial vested interests in various phases of economic development. The issues, of course, have been much more complicated than economic modernization versus ideological purification. Regional differences, arguments over military doctrine and the amount of resources to be used for military purposes, and disputes over policy toward the U.S.S.R. and the United States all have divided the top leadership at various times.

During the 29-year history of the People's Republic, Peking has made several major swings in economic policy. Because of lags between (a) the identification of a policy issue and the formation of a policy position, (b) the announcement of policy and its administrative implementation, and (c) the implementation and the appearance of results, the relationship between policy and economic reality is jumbled; exogenous factors, such as poor agricultural weather or devastating earthquakes, compound the lack of congruence between policy and reality. Policy directives that finally work their way down to the enterprise level thus may be a far cry from what their sponsors on the Party Central Committee envisioned. Moreover, implementation of policy in an economy with widely divergent local conditions almost always proves uneven. And, of great importance, as the political/economic bureaucracy expands in size and deepens its roots, the effect of policy swings on economic events becomes less and less pronounced. The appraisal that follows of the economic effects of three major political upheavals attempts to demonstrate this thesis.

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[4] For a provocative discussion of the legitimacy of classifying and categorizing social science phenomenon in the Chinese context, see the twin articles: Andrew J. Nathan, "Policy Oscillations in the People's Republic of China: A Critique," China Quarterly, No. 68, December 1976, pp. 720–33; and Edwin A. Winckler, "Policy Options in the People's Republic of China: A Reply," op. cit., pp. 734–50.

[5] *Washington Post*, Sept. 13, 1976.

A. The Great Leap Forward (1958–60)

The first 9 years of Communist rule in China were taken up with restoring the war-battered economy to full operation (1949–52) and extending its production possibilities through investment in coal, steel, and other basic industries in a Soviet-style First Five-Year Plan (1953–57). Then Chairman Mao, believing that much more output could be squeezed out of the economy, launched a program for instant industrialization, the Great Leap Forward (1958–60). This speedup of an already hard-charging economy caused great damage on all major fronts: (a) Industrial output, which had been pumped up nearly double by 1960, soon fell back to the 1957 level, with the work force exhausted, the stock of machinery half ruined by abuse and lack of maintenance, and quality standards largely abandoned; (b) agricultural output was down 20 percent because of bad weather, the establishment of unwieldy supercollectives (the communes) averaging 25,000 persons, and the issuance of impractical instructions on farming techniques from the center; the barely sufficient ration was cut 20 percent, which led to widespread hunger, malnutrition, and discontent; and (c) the Soviet technicians, who had helped set up and operate the modern factories supplied by the U.S.S.R., were summarily withdrawn by Premier Khrushchev in mid-1960 as a result of growing disenchantment with Peking's political and economic stance. The Great Leap also cost dearly in education, science and technology, and foreign trade.

As the dimensions of the debacle became clear, Chairman Mao was sidelined—treated as a "deceased old uncle," he was later to say—and the regime moved quickly and successfully to adjust policy (1961–65). It arranged for emergency rations, reinstated the village as the primary decisionmaking unit for farming operations and rural income distribution, restored the private plot, earmarked a large share of industrial capacity for the support of agriculture, limited industrial investment to a few key industries, and turned to Japan and Western Europe for selected items of modern equipment and technology.

B. The Cultural Revolution (1966–69)

Beginning with a "socialist education" campaign in 1962, Chairman Mao staged a strong political comeback. Using newspapers controlled by the professional ideologues as his platform and employing millions of teenage Red Guards as his instrument to shatter the party and Government apparatus, Mao conducted a convulsive Cultural Revolution (1966–69) [6] with two ends in mind: (a) He wished to reassert his control over the party and Government bureaucracies, which were acquiring an independent and elitist life of their own; and (b) he wished to reinvigorate the society with revolutionary fervor, rightly suspecting that the younger generation of "revolutionary successors" were soft and untested.

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[6] The term "Cultural Revolution" in this paper is limited to the period of political turbulence, 1966–69 when the Red Guards were on the march and when the People's Liberation Army (PLA) was used periodically to prevent a complete breakdown in social order; this period ended with the PLA set in authority and the Red Guards exiled to the countryside. The term subsequently has been used in the official Chinese press in a much broader sense, to designate the 11-year period of intermittent political turmoil, 1966–77. See, for example, Hua Kuo-feng's political report of Aug. 12, 1977, to the 11th National Congress of the Chinese Communist Party. Peking, HSINHUA, Aug. 20, 1977 (FBIS–CHI–77–162, Aug. 22, 1977, D5). (Throughout this paper the abbreviation "FBIS–CHI" refers to the index title of the "Daily Report: People's Republic of China," Foreign Broadcast Information Service.)

The economic damage attributable to the Cultural Revolution fell far short of the damage attributable to the Great Leap Forward. Industrial production in 1967 dipped 13 percent below the 1966 level and remained 5 percent below in 1968, whereas it would otherwise have increased 5 to 10 percent in each year. Still, damage to industrial machinery was small, and important new industrial capacity was being commissioned despite the political ferment. Finally, the agricultural sector suffered no appreciable damage of special importance, officials in rural areas were instructed to leave the private plots alone, even though newspaper editorial writers were roundly denouncing them as remnants of capitalism.

At the time Mao launched the Cultural Revolution, economic life in the PRC had settled into a rhythm centering around the daily task of making a living in farm, factory, mine, shop, or Government bureau. The assaults by Red Guards and Party polemicists, while they shattered parts of the party and Government bureaucracies, left a large portion of middle and lower level operations essentially intact. Urban areas, rail routes, and factories were hit sporadically; on any given day the great majority of factory and office workers got up, went to work, came home. Life in the countryside was not greatly disturbed, partly because Mao would not permit the nation to be brought once more to the brink of starvation.

The shutdown of higher education during the Cultural Revolution not only interrupted the flow of trained people into immediate productive tasks but also undermined long-term economic prospects. The universities were closed in the fall of 1966 and began gradually reopening only in the fall of 1970 and then on a quite limited basis. A bastion of the militant ideologues, the education sector conspicuously failed to snap back to pre-1966 standards of discipline, professional standards, and output of trained people. The loss caused by the curtailing of technical training, 1966–77, will never be ascertainable from national economic statistics; it will show up only as a general unquantifiable drag on Chinese ability to press forward simultaneously on a variety of scientific and technical fronts.

In the transitional year 1970 and the Fourth Five-Year Plan period (1971–75), the economy once more resumed the process of systematically raising industrial and agricultural capacity.

C. The Gang of Four (1974–76)

The third of the political episodes to send major shock waves through the economy was the affair of the Gang of Four. This episode was part of the political difficulties attending the transfer of power as the Long March generation of old revolutionaries passed from the scene. In 1974, as the physical decline of both Mao and Chou Enlai reached alarming proportions, the jockeying for political position became more blatant. During the year, the anti-Confucian campaign, a thinly disguised attack on Chou and the economic modernizers, reached new heights. The radicals brought disorder into economic planning and industrial production by denouncing rules and regulations, material incentives, and reliance on foreign technology.

In January 1975, the ailing Chou, speaking on the work of the Government at the Fourth National People's Congress, presented the guidelines for China's economic development over the final quarter of the 20th century. By the year 2000, China was to become a modern socialist industrial state in the front ranks of the world. The development process entailed a dedicated drive for the "four modernizations"—of agriculture, industry, national defense, and science and technology. The Fourth Five-Year Plan was to be fulfilled or overfulfilled by the end of 1975, and the State Council was to work out annual, 5-year and longer term plans that would eventually realize the grand goal for the end of the century.

While paying due respect to the ideas of the Cultural Revolution and to the smashing of various plots to restore capitalism, Chou's speech essentially sounded a call for hard work rather than ideological fervor and for technical economic planning of priorities rather than new revolutionary strategies. As his chief lieutenant in this economic modernizing process, he had enlisted the veteran party leader and experienced administrator Teng Hsiao-ping. Teng, one of 12 vice premiers appointed or reappointed at the Congress, had gotten into political trouble during the Cultural Revolution for his non-ideological approach to problems. Teng was reported to have said, "It doesn't matter whether a cat is black or white as long as it catches mice," a statement that accurately sums up his no-nonsense approach to problems. His return to the top ranks stood as one of the key signs of the dwindling fortunes of the ideologues.[7]

Chou's speech of January was followed by conferences on the iron and steel and railroad industries, two areas that had been constraining economic growth. Then in July 1975, "leading comrades" of the State Council—presumably led by Teng—drafted general guidelines for the industrial portion of the "four modernizations" program. This document, "Some Problems in Accelerating Industrial Development" (known as "the 20 points" for short), advocated (a) the vigorous development of production, that is, an end to disruptive political squabbling and a return to hard work in the factories; (b) the stiffening of managerial authority in all types of enterprises; (c) the systematic import of technology from abroad when foreign countries had something valuable to teach; and (d) increased attention to the living standards of rank-and-file workers.

Chou, working with Teng, succeeded in making the year 1975 considerably more productive than trouble-plagued 1974. Aggregate production was up 7 percent, advances being posted in agriculture, industry, transport, and foreign trade.

Toward the end of 1975 and the beginning of 1976, the radical militants stepped up their attack on the government bureaucrats and party cadres making up the economic modernizing faction. The death of Chou on January 6, 1976 removed a figure of immense prestige and authority, second only to Mao. Without his cementing influence the struggle for power intensified. Following serious disturbances in Tienanmen Square in Peking in early April, Teng—the logical successor to Chou as administrator of the Government and of the economy—was removed from his party, government, and army posts. Hua Kuo-feng was named First Party Vice Chairman and Premier. As second in command to an extremely ill Chairman Mao, Hua presided over a divided government. The militant denunciation of material incentives, rules and regulations in factories, and dependence on foreign technology reached a crescendo in mid-1976. From August 13 to October 6, it was later said, People's Daily published 110 articles and letters denouncing "the 20 points" program for orderly acceleration of industrial development.[8] Then, only one month after Mao's death on September 9, the four leaders of the Gang of Four were arrested, and Hua Kuo-feng became Mao's successor as Chairman. Teng Hsiao-ping was brought back as a leading behind-the-scenes adviser, finally being restored to open power in his old posts in July 1977.

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[7] At a later date, the author Han Suyin, a frequent visitor to the PRC, gave this thumbnail sketch of Teng: "Teng Hsiao-ping is short and stocky. Despite his 73 years, his hair is still black, his face lacking any wrinkles, and only one eyelid is a bit slack, He moves swiftly and nimbly, spits amply, and smokes continuously. He is so direct, so blunt, so completely unembarrassed that it is impossible not to like him or not to be fascinated by the absolute frankness with which he throws facts at you." (Der Spiegel, Hamburg, Nov. 21, 1977 (FBIS-CHI-77-227, Nov. 25, 1977, E15).)

The economic damage from the political battles of 1974–76, while seriously reducing the momentum of the economy, was less than the damage from the Cultural Revolution at its 1967–68 peak. In 1976, production of oil, chemical fertilizer, and electronics continued to rise while production of steel and other major commodities fell off; aggregate industrial output was roughly the same as in 1975, whereas it dropped 13 percent during the worst year of the Cultural Revolution. The industrial difficulties were a compound of dwindling respect for factory discipline, mounting resentment over the longstanding freeze on wages, and lack of strong action from the top to match inputs with outputs among the various industrial branches. Similarly, transportation tie-ups apparently were neither as serious nor as long-lived as in 1967–68. Finally, the humiliation or sacking of government and party officials was only occasionally seen in 1974–76; officials lay low and avoided initiatives, whereas in the former period thousands of high and medium-level officials were dragged from their posts by the unleashed Red Guards.

IV. Agriculture: Expanded Capacity, Mediocre Output Gains [9]

The agricultural sector in 1975–77 benefited from (a) the continued (and sometimes augmented) inflow of pumps, tractors, fertilizer, insecticides, and improved seeds; (b) a largely invisible but real accretion of technical and managerial skills; and (c) decentralization of decisionmaking and comparative permissiveness toward local and private initiative. As a result, the productive capacity of the sector moved steadily forward, bad weather keeping the growth in output behind the growth in potential. The incremental requirements levied on agriculture—an improved diet for an expanded population, additional raw materials for industry, and more export goods—were not matched by gains in output. As one consequence, starting in November 1976, Peking began contracting for large quantities of foreign grain for delivery in 1977 and 1978; 7 million tons were delivered in 1977, with a like amount in prospect for 1978.

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[8] Peking, NCNA Domestic Service, July 16, 1977 (FBIS-CHI-77-137, July 18, 1977, E13).

[9] For a detailed description of developments in the agricultural sector of the economy, see the section on agriculture in this volume.

Events in the agricultural sector under the Communist regime have been conditioned by three great policy decisions: (a) the original strategy, governing the 1950's, of leaving agriculture to rely on its own resources for growth; (b) the about-face of the leadership in 1961–62, which led to massive inputs to the agricultural sector from the industrial sector and to a practical, decentralized organization of the countryside; and (c) the decision to substantially step up agricultural investment in 1972, including the purchase of 13 large chemical fertilizer plants, 9 of which had been commissioned by yearend 1977.

The agriculture sector thus has been expanding productive capacity along several different lines. A number of these lines fall under the program pushed by Peking of "farmland capital construction." This program features reclamation of acreage for agricultural use, the leveling of land for more effective cultivation, the building up of quality of soil, and the creation or improvement of irrigation and drainage systems.

At the same time that cropland is being reclaimed from marshes and arid areas, land is being lost to other uses: (a) extensive acreage is being commandeered for newly created industrial centers, as the Government pushes industrialization into the countryside; (b) simultaneously, rights-of-way for new highways and railroad links must be provided, in some instances at the expense of the best cropland; (c) irrigation canals, dams, and drainage ditches themselves take a toll; (d) the great afforestation programs are carried out mainly on wasteland but also involve lands variously suited for crop use; and (e) the growth in rural population and the improvement in rural housing standards claim a small percentage of the land each year. The official press, in noting the problem of lost agricultural acreage, urges the adoption of a typically bureaucratic solution—the giving of priority to the work of party land-use committees, under instructions to provide adequately for the needs of all claimants.[10] In the absence of firm national statistics, one can guess that the forces adding to and subtracting from cropland largely balance off.[11] What is certain is that the average quality and yield of the land is being substantially improved and that promising opportunities for further improvement have not yet been exhausted.

Because of the existence of vast labor resources in both rural and urban areas, inputs of machinery and equipment are valuable for raising yields per hectare rather than for releasing manpower to other tasks. For example, irrigation pumps and insecticide tanks presumably boost aggregate farm output more than mechanical cotton pickers. Even so, cultivating and harvesting machinery helps raise output, for instance, when machinery speeds up harvesting and planting so much in peak seasons that a second or third crop may be squeezed into the annual production cycle. Furthermore, a small amount of heavy construction equipment can greatly reduce the amount of backbreaking labor even when it does not perform operations beyond the power of gangs of determined men. The pay-off for machinery and equipment remains high at the margin because there is so little of it in relation to the vast countryside. The present campaign for furnishing agriculture with additional equipment employs the slogan "basically achieve agricultural mechanization by 1980." [12]

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[10] For a call for proper land use and for an end of illegal transactions in land, see Peking Domestic Service broadcast, Dec. 13, 1977 (FBIS-CHI-77-241, Dec. 15, 1977, E12-13).

[11] For the judgment that the potential for expansion of cultivated land is "extremely limited," see the report of several plant scientists and water use experts who visited the People's Republic in August-September 1974, in Dwight H. Perkin's "A Conference on Agriculture", China Quarterly, No. 67, September 1976, p. 598.

As for labor inputs, no doubt the steadily increasing standards of health, literary, and technical job skill constitute a major force pushing out the production possibilities of the agricultural sector. These positive factors contribute a qualitative element of more relevance than raw manpower to China's agricultural needs. Naturally progress is uneven among regions and communes. As part of the general upgrading, tens of millions of rural youth have been receiving training in seed selection, operation of machinery, paramedical techniques, weather prediction, well-drilling, and other skills. On the other hand, long-term basic research in agricultural science was badly disorganized in 1975–77 because of the fierce political infighting over control of higher education and research; many of the organizations performing long-term agricultural research were broken up and their members scattered about the countryside.

A unique feature of manpower policy in the last 10 years has been the transfer of "well over 16 million" young people, mainly middle-school graduates, from urban areas to the countryside. These young people have sometimes been incorporated directly into existing villages and towns, sometimes in separate units of their own. The press reports that 6 million have subsequently been transferred to "industry, communications, trade, culture, education, and other departments," with "nearly 10 million * * * still working in the rural areas and frontier regions." [13] Many of those transferred did not go back to their home cities but were assigned to the rapidly expanding industrial cities of the hinterland and to rural administrative centers and construction sites.

The system of agricultural organization—the three-tiered commune, with its production brigades and production teams—has proved remarkably effective, especially by the standards of the other Communist command economies of the Union of Soviet Socialist Republics and Eastern Europe. The strengths of the system include its compatibility with the traditional village structure of rural China, its decentralization of day-to-day farming decisions to the village level, and its provision for discreet private activity in the form of private plots, handicrafts, and petty trade. About one-fourth of the total agricultural and subsidiary products purchased by the state network comes from household sideline production.[14] Since no more than 5 percent of the land is worked privately, this attests to both the enthusaism of ths farmer in tilling his private land and the good sense of the authoritiee in tolerating "unMarxist" activity.[15]

As to actual farm output in 1975–77, aggregate grain production rose 3 percent in 1975, then remained the same in 1976 and 1977because of serious floods and droughts. Nongrain crops probably did a little better, and collective and communal livestock numbers rose appreciably.

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[12] For a major report by state planning chief Yu Chiu-li on agricultural mechanization, delivered at the Third National Conference on Agricultural Mechanization, see Peking NCNA Domestic Service, Jan. 28, 1978 (FBIS-CHI-78-21, Jan. 31, 1978, E6-25).

[13] Peking NCNA, Jan. 24, 1978 (FBIS-CHI-78-16, Jan. 24, 1978, E18-19).

[14] People's Daily, Peking, Nov. 16, 1977 (FBIS-CHI-77, Nov. 22, 1977, E2).

[15] For an account of the status of state farms, which are not considered in this brief assessment of China's agricultural sector, see the People's Daily editorial, "State Farms Must Take a Giant Stride Forward", Jan. 26, 1978 (FBIS-CHI-78-20, Jan. 30, 1978, E6-9).

In the assessment of long-term prospects, a bright spot is the growing output and rising technology of small-scale industrial plants owned by communes and production brigades. These plants, which employ 10 percent of the commune labor force, provide a critical addition to rural investment and rural standards of living. They turn out agricultural implements, cement, bricks, low-grade but serviceable chemical fertilizer, small electrical products, textiles, and food products. Some of these plants supply parts for big plants in the cities. Peking claims that 23 percent of commune income is generated by these plants.[16]

As for the on-going "Learn From Tachai" campaign (the high-pressure campaign for self-reliance in the countryside), a new goal was announced in 1977, namely, that one-third of China's rural counties are to be shaped up to Tachai standards by 1980. Before their fall, the Gang of Four emphasized those features of the Tachai campaign that were especially to their liking and that had been previously put forward under the heading of "developing the new Communist man." These features included the stress on overcoming nature through man's dedicated revolutionary spirit, the scorning of state support even in time of natural disaster, and the focusing on collective rather than individual wants. The new Hua administration, with its pragmatic bent, stresses organization and hard work in the brigades and teams, while denouncing the Gang of Four for begrudging the peasants a few extra chickens.[17]

V. INDUSTRY: BOTTLENECKS AND UNEVEN GROWTH [18]

Industrial production rose 10 percent in 1975, stayed level in 1976 because of the political turmoil, and climbed perhaps 14 percent in 1977. The average annual rate of growth for the 3 years thus was a point or so below the 9-percent annual long-term industrial growth rate. Output of oil, chemical fertilizer, electronics, and motor vehicles sharply increased in the period, whereas coal, steel, and electric power became serious bottlenecks in the economy. The leadership almost certainly was disappointed by the failure to upgrade quality of machinery production and to replace the obsolete models being produced.

For more than a decade, investment in new modern mines and shafts in the coal industry has lagged far behind requirements. Deficiencies have been made up by the intensive working of old mines, economy in the use of coal, and imports. The tenuous supply situation was jolted in July 1976 when an earthquake devastated the area around the northern coal-mining city of Tangshan killing 650,000 people. A mammoth reconstruction effort has gotten the area back into operation.

Extensive investment in basic steel facilities has not been matched by investment in steel-finishing capacity. China thus has had to import millions of tons of steelmill products each year. At the same time, demand for steel for shipbuilding, rails and railroad rolling stock, construction, pipelines, and military equipment continues to mount. Shortages of coal and iron ore have compounded the industry's problems.

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[16] Peking NCNA, Jan. 3, 1978 (FBIS-CHI-78-4, Jan. 6, 1978, E19).

[17] See, for example, the Haikow Hainan Island Regional Service report of Jan. 9, 1978 (FBIS-CHI-78-8, Jan. 12, 1978, H9-10).

[18] For a detailed description of developments in the industrial sector, see especially the paper in this volume by Robert Michael Field, Kathleen M. McGlynn, and William B. Abnett.

Like other Communist countries, the PRC has chronic shortages of electric power, caused by the rapid advances in the needs of industrial enterprises and households, the construction of new industrial towns in remote areas, and persistent shortages of inputs into the industry, such as coal. China boasts the largest hydroelectric potential of any nation; unfortunately for the planners, most of the best sites lie in areas far removed from the leading industrial centers.

In 1976 particularly, the political uncertainties resulted in confusion in the industrial chain of command and lax factory discipline, workers spending too much time smoking and watching cricket fights. Since even Chinese officialdom concedes that industrial output stagnated in 1976 and since production of oil, chemical fertilizers, and other leading products was rapidly climbing, output must have declined sharply in many other individual branches. The 14-percent rise in industrial production in 1977 largely represented comebacks in factories where management had stiffened its control and/or supply difficulties had been resolved.

The political ruckus of the last few years served merely to moderate what was fundamentally an enormous investment effort. New oilfields were opened or expanded in north and northeast China; new provincial industrial centers, some numbering hundreds of thousands of people, were extended with the aid of skilled workers from the established centers; deliveries peaked (in 1975) on the wave of new orders for complete sets of foreign equipment that had been signed in 1972–74, the most important being the new chemical fertilizer plants; production of computers and other electronic equipment continued upward, in turn contributing to the general growth in capacity; and the aggregate capacity of small-scale plants at the county and commune level mounted, although without a strong coordinated push from the center.

In short, even though industrial performance fell below expectations in the period 1975–77 as a whole, sizable gains were chalked up in output, capacity, and even technical level. The ingredients for further major advances are in place—the vast natural resources, the enormous numbers of skilled and trainable workers, and the constantly expanding capital plant. The Hua administration has already instituted at least four policies that will help exploit this potential: (a) a strengthening of managerial authority; (b) a priority push for high level technical training; (c) an avowed willingness to tap the advanced technology of capitalist countries (provided no infringement of sovereignty is implied); and (d) the granting last October of long-delayed pay increases to three-fifths of the urban work force, most of the increases going to those in the lower pay brackets.

Under the Learn from Taching campaign in industry, the government has been exhorting workers to emulate the work pace and achieve the production results of the great Taching oilfield from which China gets half of its petroleum. This speedup campaign probably contributed little to industrial output in 1975–77, since each industrial enterprise had to wrestle with its own problems on local terms—how to scrounge supplies of coal or other basic materials, how to deal with specific transport delays, how to get housing for its restless work force, and how to obtain spare parts for its Soviet-built equipment. The Hua government has been sponsoring numerous national and provincial Learn from Taching conferences. The success of industry, however, would seem to depend more on the regime's more specific button-down-to-work measures and its specific plans to expand capacity, either from domestic resources or with the aid of foreign equipment and technical support.

VI. MILITARY INDUSTRY: CONTINUED RESTRAINT

Production and procurement of military hardware peaked in 1970–71. In 1972, hardware production fell by 25 percent, probably because of three interrelated factors: (a) reassertion of civilian influence in policymaking, the military leaders having moved into the power vacuum that resulted from the partial shattering of government and party structures during the Cultural Revolution; (b) the preemption of resources for a new wave of investment in agriculture; and (c) a reluctance to devote additional resources to building out-of-date weapons and a willingness to wait upon the development of a new generation of weapons.

Production and procurement of hardware remained at the lower 1972 level through 1974, falling still further as a share of GNP. In the period 1975–77, output gradually increased, although at a considerably slower rate than overall industrial output.

While superior to all other LDC's in ability to produce modern weapons—the PRC manufactures jet aircraft, nuclear-armed missiles, and submarines, some of its own design—the Chinese have not succeeded in narrowing the gap separating them from the leading industrial nations. They are experiencing development and production problems on their more advanced weapons for all branches of the service. Their failures have been the result of their general industrial backwardness, their refusal to rely on foreign sources of equipment and technology during periods of political upheaval, and the caution of major military powers in supplying China with the know-how for military production.

Even with the restrained level of military hardware production, the equipment and capabilities of the People's Liberation Army (PLA) were appreciably upgraded in 1975–77: (a) the ground forces, which account for more than 80 percent of the 4 million men under arms, added substantial numbers of tanks, artillery pieces, and trucks to their inventory; (b) the naval forces, in addition to adding dozens of small coastal craft, continued the commissioning of destroyers, frigates, and submarines to forward the development of a deep-water capability; (c) the air forces continued to expand and laid the groundwork for new model fighters (one to be equipped with the recently acquired British Spey engine); and (d) the missile forces continued the deployment of short-range and medium-range nuclear-armed missiles, meanwhile pushing development on long-range models. The PLA's equipment still remains one or two generations behind the equipment of the other leading military powers.

The Chinese military establishment continues to be in an unmatched position with respect to manpower: (a) only 1 youth in 10 is selected from each age cohort, and thus he meets extremely demanding standards of physical fitness and political reliability; (b) recruits are willing volunteers since the military service still excels alternative opportunities in prestige, material advantages, excitement, and travel; (c) recruits have comparatively little problem in adjusting to the rigors of military life; (d) the steady widening of primary and secondary education means that recruits meet increasingly higher educational standards; and (e) the most recently discharged classes form a top-flight ready reserve.

At the same time that the production of military hardware is being held under wraps, considerable effort is going into civil defense. This program, which features digging and stocking large underground shelters, uses resources of comparatively low opportunity cost—labor hours that are over and above regular job hours; locally available equipment; simple construction materials, often of local origin; and emergency stocks that probably were going to be held in any case.

VII. Foreign Trade: The Cutting Edge [19]

The political infighting of the last 3 years contributed to a reduction in the inflow of foreign machinery and technology. The role of foreign trade in the Chinese economy nonetheless remained fundamentally the same as in the early 1970's.

1. Since the People's Republic can feed itself, produce its own basic machinery, and provide essentially all industrial raw materials out of its own vast natural resources, it has a smaller stake in foreign trade than any other major nation on the globe—with the important exception of certain kinds of advanced technology.

2. Chinese foreign trade involves the exchange of: (a) crude oil, coal, ores, foodstuffs, simple machine tools, textiles, bicycles, sewing machines, and other manufactures for (b) equipment and technologies for oil exploration, coal mining, steelmaking, electronics, chemical fertilizer, power generation, and the petrochemical industry; chemical fertilizer, pesticides, plastic sheeting, crop seed, and domestic animals for breed-stock; grain; and smaller amounts of sugar, chemical fabrics, wrist watches, television sets, and other consumer goods.[20] Starting in 1961, the PRC has imported several million tons of grain annually from non-Communist countries, at first on an emergency basis but then later as an economical way of feeding large northern cities. Imports of grain were 3.3 million tons in 1975, 2.0 million tons in 1976, and 6.8 million tons in 1977, and they are expected to amount to 7 million tons in 1978.

3. Foreign trade provides the cutting edge of the general program for economic modernization, with the key imported technologies being those listed in the preceding paragraph. The dislocations in higher education within China makes this dependence much deeper and more protracted than otherwise.

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[19] For a detailed description of developments in the foreign trade sector, see the section on foreign economic relations in this volume.

[20] For a brief account of foreign trade results in 1977, from which most of this list was taken, see Peking NCNA Jan. 15, 1978 (FBIS-CHI-78-10, January 16, 1978, E19).

4. More than 80 percent of China's trade is with non-Communist partners in contrast to the late 1950's when two-thirds was with other Communist nations, predominantly the U.S.S.R.

5. From the beginning the PRC has insisted on a balance of exports and imports, thus avoiding many of the financial and political problems of less straitlaced developing countries. Only recently has Peking relaxed sufficiently to OK a few major deals involving deferred payments for complete sets of equipment.

6. Bilateral trade with major partners, however, is far from being in balance. Of critical importance is the $1.5 billion annual trade surplus earned through provisioning the Crown Colony of Hong Kong (the figure includes reexports of Chinese goods); in addition, the PRC enjoys a substantial surplus with the less developed countries. These surpluses enable the People's Republic to run deficits with its suppliers of modern machinery and industrial materials—Japan and Western Europe. The following tabulation for 1976 illustrates this general pattern:

[In billions of dollars]

Area	Exports to	Imports from	People's Republic of China balance
Hong Kong	1. 59	. 03	+1. 56
LDC's	1. 69	. 77	+. 92
Japan	1. 31	1. 75	−. 44
Western Europe	. 98	1. 69	−. 71
United States	. 20	. 15	+. 05
U.S.S.R	. 18	. 24	−. 06
Eastern Europe	. 44	. 55	−. 11
World	7. 25	6. 00	+1. 25

7. The People's Republic reaps substantial gains from comparative advantage in foreign trade. It exports products that have a high labor and natural resource content, and imports products that it could produce, if at all, only with a great expenditure of scarce high-technology resources. It exports products, such as specialty foods, silk textiles, and high-grade handicrafts, that command a high price abroad but are of low-priority usefulness at home; with these earnings it imports wheat, steel-mill products, and electronics that command a comparatively low price in world markets but are of high-priority usefulness in running and expanding the economic machinery at home.

After running an $800 million trade deficit in 1974, when world recession dampened the demand for Chinese products, Peking made the expected adjustments to restrain imports and encourage exports. The result was a much lower deficit of $200 million in 1975. The year 1976 began with a spurt of imports of equipment, followed by a general collapse of foreign purchases in the second half of the year when the divided leadership was unable to agree on major economic development plans.[21] This sudden fall in imports led to an unanticipated trade surplus of $1.25 billion for 1976 as a whole. The partial restoration of economic order in 1977 resulted in a rise in the real volume of trade, the overall trade balance standing at a plus $1 billion

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[21] For details on recent trade patterns, see CIA, "China: International Trade, 1976–77," ER 77-10674, November 1977.

(preliminary figure, based on exports of $7.8 billion and imports of $6.8 billion). Another result of the more businesslike approach of the Hua administration is the greater attention now being given foreign buyers' requirements for particular labeling and packaging.

As part of the exchange of China's raw materials and labor-intensive manufactures for capital-intensive industrial equipment and materials, several hundred foreign technicians are currently stationed in the People's Republic to help with the construction and operation of new facilities. The majority of the technicians are Japanese. The small number of U.S. technicians in China are concentrated in the oil and petrochemical industries.

In February 1978, the PRC signed a $20 billion trade pact with Japan which called for even closer relations over the next 8 years (1978–85). In this period, China plans to purchase $7 to $8 billion worth of Japanese plant and technology, including a 6-million-ton steel complex to be built at Shanghai. Japan committed itself to double its imports of Chinese crude by 1982, which will require substantial modifications in certain Japanese refineries because of the high wax content of the oil.

VIII. Living Standards: Impatience With Moderate Advances

Behind the political turmoil and the sporadic breakdown of order and discipline in many factories, living standards gradually advanced over the past 3 years. Millions of persons moved up to better jobs because of the expansion of industry (especially in the better-paying branches) and the general growth in professional, technical, and service jobs. Per capita savings deposits and stocks of consumer durables in use stood substantially higher at yearend 1977 compared with yearend 1974. For the most part, the People's Republic continued to avoid both extremes of poverty and extremes of wealth. The gradual advance in living standards fell short of satisfying an impatient populace. Families, their basic requirements now secured, wish to move up to higher levels and new types of satisfactions. People are less and less moved by dramatic comparisons with the bad old days under capitalism.

In 1975–77, the increase of population, by roughly 20 million people a year, prevented any fundamental improvement in the food situation, especially since unfavorable weather held back grain production. Grain, cooking oil, and sugar continued to be closely controlled by the state through its long-established procurement and rationing system.

Cotton cloth continued to be rationed in the last 3 years, and any improvement in the quantity, quality, and variety of clothing and other textiles probably was small.

Even though housing remains generally cramped and spartan, millions of Chinese families took a step up the scale in 1975–77; numerous additional apartment blocks rose in urban areas, and housing in rural villages was steadily upgraded through the use of local materials and self-help labor.

Ownership of various consumer durables grew rapidly, sometimes from a small base. The stock of bicycles grew by about 15 million in 1975–77, or by approximately one-third. The number of radio sets in Chinese households was roughly doubled. Substantial increases were also registered in the stock of sewing machines, watches, and TV sets (most sets are owned collectively by labor unions, schools, hospitals, and recreation centers). Buyers of large consumer durables still must present a certificate of authorization from their workplace; these certificates are normally awarded to workers who are both diligent and politically sound.

Services provided by the state generally rose on a per capita basis in 1975–77. Higher education began its real recovery only after October 1976, but primary and secondary education apparently was being spread gradually to outlying areas throughout the entire period. Health care was palpably strengthened by the training and dispatch of hundreds of thousands of doctors, nurses, and paramedics to the countryside. The populace benefited from an increase in sports and other popular leisuretime activities. Although literature and art were largely drained of entertainment value by the Gang of Four, the more stringent controls have already been relaxed by the new Hua regime.

Whereas the Government of the People's Republic has not leveled all incomes, it has succeeded in placing a floor under consumption and in restraining high living by the new class of party and Government administrators. The remaining income differentials are sizable. As the system of organization and control has taken root and as individuals remain tied to their jobs, many of these differentials seem to be hardening. In the last 3 years, distinctions among different lifestyles became more clear and more apparent: first, the differences between the drabness and monotony of rural life and the amenities and variety of city life. Second, within agriculture, the difference between life in the rich commune, typically located on good land on the outskirts of a large city, and life in a poor commune, located in the outback on thin soil, sometimes without road connections or electricity. Third, within urban areas, the difference between life as an employee of a state organization, with regular salary and extensive fringe benefits, and life as a member of a handicraft collective or as a contract worker, with irregular income and few fringe benefits. Fourth, the difference between life as one of the 95-percent politically cleared people and life as one of the 5-percent underclass, made up of common criminals, political opponents of those in power, and persons of bourgeois lineage.

Recent visitors to China have noted the great importance still accorded to differences in status and rank. The Chinese still feel uncomfortable if the rank of individuals within any group is not clearly established, and both open and subtle distinctions persist in the bearing, the garb, and the perquisites of persons of different status.

As in other Marxist-Leninist societies, the Government cannot control many of the fine details of household economic life—or, if it tries, it finds the cost in economic resources and popular anger too high. So long as the main problem in living standards was the supply of a few staple rationed goods, the PRC leadership could run the consumer sector as a "barracks economy," complete with supply rooms (state stores), supply sergeants (state clerks), and supply requisitions (ration chits). With the gowing complexity of economic life in China, an extralegal "second economy" is developing to fill in the interstices of the formal economic plans and to meet the practical needs of daily life that are beyond the scope of the plans.[22]

IX. POPULATION: INITIAL SUCCESSES IN CONTROL PROGRAM [23]

In 1975–77, China's critically important population control program forged ahead largely on its own momentum. Fragmentary evidence points to an extension of the campaign outward to rural areas, an increased availability of birth control information and contraceptives, and a continued marked decline in the percentage growth of the national population.

The population control program pushes in the same direction as many of the general modernizing influences at work in the PRC. In one generation, provision of a floor under food consumption, improvements in public health, and the absence of civil warfare have completely changed the mortality patterns and have begun to modify attitudes toward the optimum number of children. The provision of social security through governmental units and mass organizations as well as through the family has lessened the vulnerabilities of old age and hence the long-term value of children as economic props. The strong push for universal education of children and the generally revised cost/benefit calculus with respect to children—costs are up, economic benefits down—suggest changed social attitudes. Because of both higher educational levels and the sustained propaganda of this third great population control campaign a growing number of Chinese are recognizing that there are too many mouths to feed. The shortage of housing space, together with the raising of the populace's housing standards, also weighs in the balance against having additional children.

The straightforward provisions of the program—later marriage, delay in having the first child, and fewer children—are being administered through an elaborate network of organizational units at all levels. The Kiangsu provincial conference on planned parenthood in late 1975 emphasized these organizational aspects; for example, "It is essential to give full play to the role of trade union councils, poor and lower middle peasant associations, women's federations, CYL organizations, militia units, and other mass organizations as well as departments concerned in this regard." [24] Population growth in Kiangsu had been slowing down, it was claimed, as follows: 1965, 2.75 percent; 1972, 1.509 percent; and 1974, 1.073 percent.

Population goals have apparently become a part of the annual and longer term plans at all levels. In the past 3 years, the assignment of annual "baby quotas" to base-level urban and rural units has spread. The quotas are distributed within the unit on the basis of discussions of which married women of child-bearing age have a turn coming up. The tight-knit organizational control established in the People's Republic makes this a feasible way at enforcing population goals. At present, the number of areas in which baby quotas are imposed and the degree of success in the general control effort are not known.

The national population figures used in this paper are the latest mid-range U.S. Department of Commerce figures as prepared by demographer John Aird. This series shows that annual growth in the Chinese population ranged between 2.3 and 2.4 percent in 1967–71. As set forth in the tabulation, the estimates and projections for 1970 through 1985 (the last year of the new 10-year plan) show the rate being pressed down to 1.3 percent by 1985. The quite prominent jump in the series in 1977 is the result of an unusual combination of forces, including (a) the semiparalysis of the population control program in 1976 when political infighting reached new heights, (b) the continued entrance of record numbers of females into the child-bearing age group and the continued exodus of small cohorts of old people, and (c) the tapering off of the once-and-for-all gains from the policy of raising the age of marriage.

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[22] For a vivid description of the operation of the "second economy" in the U.S.S.R., see Hedrick Smith, "The Russians," New York, Quadrangle, 1976.

[23] For a detailed description of developments and issues in the field of population, see John S. Aird's paper in this volume.

[24] Report of Nanking Kiangsu Provincial Service, Dec. 14, 1975 (FBIS–CHI–75–242, Dec. 16, 1975, p. G4–5).

Annual increase	*Percent*	*Annual increase*	*Percent*
1970	2. 38	1978	2. 04
1971	2. 31	1979	1. 86
1972	2. 20	1980	1. 70
1973	2. 10	1981	1. 59
1974	2. 00	1982	1. 50
1975	1. 98	1983	1. 42
1976	1. 98	1984	1. 37
1977	2. 26	1985	1. 33

X. PROSPECTS: MOVING AHEAD AT REDUCED RATES

A. On Balance, an Impressive Economic Performance

The overall economic performance of the People's Republic has outshone the performance of all but a handful of the less developed countries. The provision of adequate food, elementary health care, and basic education for the Chinese people is alone a tremendous achievement. The capital construction efforts in agriculture and the growing mastery of industrial technology are other broad-spectrum successes. The nationwide population control campaign has begun to gather momentum and has contributed to a perceptible decline in the growth rate. The People's Republic has outpaced the other LDC's in preventing disruptive rural-to-urban migration, in effectively mobilizing its labor resources, in steadfastly avoiding large-scale foreign debt, and in building up its own military industrial capabilities. Real consumption, while still low, has been rising at an average annual rate of 3 percent per capita. By and large, the Chinese people have been spared unemployment, inflation, abject poverty, conspicuous consumption, and foreign payments crises.

Naturally, not all is beer and skittles. The great political upheavals of the past 29 years have caused economic growth to be irregular, have resulted in the death, physical harassment, and incarceration of thousands of harmless persons, and have worked great economic hardship on tens of millions of households. As for the general economy, a large portion of the jobs are grueling, low-paid, and sometimes dangerous. The worker or peasant is tied to his job. He can be moved at the whim of the state, even if this means rustication to a godforsaken frontier area or separation from his spouse. He is not free to travel, not free to use his leisure time as he wants to, not free to ignore the campaigns for adjusting his political outlook, and not free to buy and sell on his own. With the establishment of a floor under consumption and job security and with the steady spread of education, many Chinese have moved their aspirations to a higher level of material and psychic satisfactions. The resulting change in attitudes is being intensified by the fading away of the generation with memories of the terrible economic hardships of the old days. Perceived wants are moving ahead faster than the ability to supply these wants. Since the downfall of the Gang of Four, restrictions on travel, books, entertainment, contact with foreigners and foreign ideas, and religious observances have been eased a little.

B. Growth Rates: Can They Be Maintained?

Even though estimates of Chinese economic growth rates suffer from the paucity of data and the lack of free access by knowledgeable observers to the various sectors of the economy, the general economic trends since 1949 have been clearly identified and thoroughly discussed, as witnessed by the Joint Economic Committee volumes. These appraisals serve as a starting point for an analysis of prospective growth rates over the next several years. The following discussion of growth prospects deals with: (a) the 10-year growth targets announced by Chairman Hua Kuo-feng in early 1978; (b) the long-term growth rates achieved so far in the PRC; (c) the formidable growth factors present in the economy; (d) the leading forces pressing down growth rates; and (e) a perspective on likely growth rates through 1985, with a distinction between prospects for the next 3 years and longer term prospects.

In his 3½-hour report on the work of the Government, delivered at the first session of the Fifth National People's Congress on February 26, 1978, Chairman Hua Kuo-feng announced highly ambitious targets for a new 10-year plan. The new plan, which covers the period 1976 through 1985, has absorbed the ongoing Fifth 5-Year Plan (1976–80). Chinese economic planners are still thinking in terms of 5-year intervals, however, as evidenced by continued references to achievements planned for the next 3 years, that is, through 1980, as well as to goals for 1985, 5 years further ahead.

A key passage in Hua's report reads as follows: [25]

> According to the ten-year plan, by 1985 we are to produce 400 billion kilogrammes [400 million metric tons] of grain and 60 million tons of steel. In each of the eight years from 1978 to 1985, the value of agricultural output is to increase by 4 to 5 percent and of industrial output by over 10 percent. The increase in our country's output of major industrial products in the eight years will far exceed that in the past twenty-eight years. In these eight years, state revenues and investments budgeted for capital construction will both be equivalent to the total for the past twenty-eight years.

Another important target announced by Hua was the continued lowering of the national population growth rate, to less than 1 percent by 1980.[26]

As for historical growth of output, rates in the periods of rehabilitation (1949–52) and the First 5-Year Plan (1953–57) were exceptionally high, being calculated from a small base and representing in large part the once-and-for-all gains obtained by putting to use great amounts of unemployed labor and capital. More representative rates of growth are obtained by using the reasonably normal year of 1957 as a base and calculating the rates over the two decades, 1958–77:

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[25] Peking, NCNA, Mar. 6, 1978 (FBIS-CHI-78-52-Supp, Mar. 16, 1978, p. 14).

[26] Ibid, p. 27. This goal, while possibly attainable by 1990, is not consistent with Aird's mid-range population series in section IX, above.

	Growth rate	Growth rate per capita
GNP	5.5	3.2
Grain output	2.0	–.1
Industrial output	9.1	6.8
Population	2.2	

This growth tabulation clearly shows the general pattern of economic development, that is, the rapid increases in industrial output, while grain output barely keeps up with population. The lag of agricultural output behind industrial output should not be taken as evidence of failure on the part of the Chinese leadership, since (a) agriculture, with its reliance on land and the seasonal cycle of growing conditions, inherently lacks industry's potential for high growth rates, and (b) the grand economic strategy of the Communist government stressed the maximizing of industrial growth rates, so long as the population was getting its basic food requirements.

Poor weather conditions prevented any significant increase in grain output in 1976–77. If the growth rate for grain is calculated for the period 1957–75, the figure is 2.2 percent, equal to the estimated population growth rates, rather than slightly below as in the tabulation. While the data are not accurate enough to put much weight on this distinction, the main point remains firm—grain output in China has been roughly matching population growth over the long haul.

Several important factors argue for substantial economic growth over the 8 remaining years of the recently announced 10-year plan:

1. The investment of one-quarter of GNP to rapidly build up the nation's productive capacity.
2. The continued existence of rural capital construction projects with a high payoff.
3. The renewed advances of industrial technology, bolstered by the Hua regime's greater acceptance of foreign equipment and its revitalization of domestic science and higher education.
4. The continued restraint in the allocation of high-technology resources to military industries.
5. The potential for further striking gains from foreign trade, via the route of comparative advantage.
6. The continued rise of per capita consumption in a variety of small ways, a trend that permits greater experimentation with material incentives.
7. The existence of an effective and low-cost administrative apparatus for reducing population growth still further, thus reducing pressures to shift resources from investment to consumption.
8. In general, the apparent settlement of leadership issues and the ascendancy of the economic modernizers at the expense of the militant ideologues.

Formidable as these progrowth forces seem, they do not guarantee a continuation of 5½-percent GNP growth and 9-percent industrial growth through 1985. While the short-term potential for high growth rates is quite promising because of sizable "catch-up" possibilities, the longer term prospects are for a drifting down of the GNP and industrial rates as opposed to the increases envisioned in the new plan.

In agriculture—where fertilizer and other inputs have been supplied in mounting volume and where poor weather has kept output from increasing in 1976 and 1977—the return of moderately good weather could raise grain output by 20 million tons in 1978, or to approximately 305 million tons. Beyond 1978, if the 400-million-ton goal of the 10-year plan were to be met, the average gain through 1985 would have to be 13 or 14 million tons. This figure is considerably more than double the trendline increment of about 5 million tons experienced in the two decades since 1957. If grain production in 1978 were actually 305 million tons and growth through 1985 were at 2 percent, production in 1985 would reach 350 million tons, that is, a more plausible average increment of 6 or 7 million tons.

In the last 15 years particularly, progress in agricultural growth has been promoted through large-scale investment in areas of "high and stable yields." Because of the comparative fixity of cultivable acreage and the rapid using up of the most attractive investment opportunities, this investment almost certainly will show evidence of declining return at the margin—at least beyond 1980. But, since the increments of grain and other agricultural products presumably must be at least maintained, the industrial inputs into the sector must be more than proportionately increased, leaving less investment resources for nonagricultural use. If an all-out effort were made to achieve the 400 million tons announced by Hua—which would mean, as explained above, more than doubling the annual increment—the pressure to increase industrial support will be intense.

To compound the problem, agricultural labor is now being subject to some of the same allocational stringencies as land. This is generally the result of the Government's past successes in making good use of China's vast underemployed labor resources. In the wake of the Great Leap Forward disaster, the programs for the establishment of rural industries were rationalized so that the small plants became effective suppliers of farm tools, building materials, chemical fertilizer, and basic consumer goods. The millions of workers brought into small-scale industry were of comparatively little importance to farming operations. Now, however, as multiple cropping and interplanting are used more and more to drive yields ever upward, labor must be more intensively applied; the result is that labor is now taken away for rural industry at a higher cost.

Finally, the development of agricultural science in China has emphasized short-term gains in output at the expense of long-term basic research; this foreshadows considerable difficulty in coping with the newer phases of agricultural modernization.

A great potential danger to agricultural efficiency is the possibility—occasionally advocated in the press—that agricultural production teams will be consolidated into production brigades or, failing this, that the brigade will take over as the primary unit of accounting and income distribution. Up to now, Chinese agriculture has proved far more successful under a Marxist-Leninist political system than has Soviet agriculture; the Chinese leadership most of the time has proved more willing to decentralize decisions and has not permitted a drain of able-bodied labor from the countryside. One of the most productive steps Peking could take would be to further extend the boundaries of enterprise permitted the production team and its member households.[27] Such a move would conserve administrative resources, raise morale, improve living standards, and possibly generate large additional quantities of export goods.

Industry's 9-percent growth pace, if continued, would result in a doubling of output every 8 years. Given the enormous expansion of China's industrial base since the Communist takeover, a doubling of Chinese industrial output in the next 8 years would be an extremely formidable task even if surrounding factors were all favorable. Yet, at least three of these elements raise doubts. First, as described above, industry almost certainly will have to bolster its support of agriculture in order to offset the relative decline in the supply of other factors.

Second, the great industrial construction projects probably cannot be expanded to the extent needed to support a 9-percent growth rate. Some elements that may be lacking are: (a) Sufficient hard currency to greatly step up purchases of foreign plants; (b) sufficient flexibility in the economy to digest ever greater numbers of construction projects, with their requirements for extensive local resources and for the admission of still more foreign technicians; and (c) enough indigenous engineers and technicians to build and operate that many new industrial facilities, especially when the higher educational system has been in turmoil for a decade. To break the major bottleneck in steel, Chairman Hua has proposed a doubling of steel capacity by 1980, so that production can be raised to 60 million tons. This goal seems unattainable. Even if (a) the Japanese help the PRC build a new 6-million-ton complex at Shanghai and complete a 5-million-ton expansion project at Anshan, and (b) other mills are upgraded and expanded by an aggregate amount of 10 million tons capacity, China will fall short of the 60-million ton goal by 10 million tons in 1985. Third, the chronic problems in the U.S.S.R. and Eastern Europe have amply demonstrated the inflexibility and the lack of dynamism of a socialist command economy in dealing with the complexities of modern technocratic society. The drive toward industrial modernization in China thus almost certainly will entail growing failure to complete construction projects on time, increasing difficulties in moving technology expeditiously from laboratory to production line, and the spread of quasi-legal practices as the only hope of meeting plan goals.

In summary, the People's Republic may temporarily exceed its historic growth rates in 1978–80, since both agriculture and industry possess substantial "catchup" opportunities after their recent mediocre years. Beyond 1980, growth rates, while gradually drifting downward, should remain quite respectable by world standards.

APPENDIX A. UPDATING OF SIMPLIFIED GNP ACCOUNTS

The estimates of China's gross national product (GNP) used in this article come from an updating of the simplified GNP accounts of the author's previous paper.[28] The GNP discussion in that paper benefited from a critique by K. C. Yeh of the Economics Departemnt of the Rand Corp. It had been the author's intention in the present piece to use the results of a thoroughgoing reconstruction of China's GNP accounts being carried out in the Central Intelligence Agency with the extensive help and guidance of Yeh. Unfortunately, the results of this research will not be available until later in 1978, when they are slated to be published as a second volume of this compendium.

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[27] For a wry and persuasive account of how Chinese entrepreneurial spirit can flourish even in a flinty socialist environment, see Norman Macrae's section of "Three People's China", The Economist, Dec. 31, 1977, especially pp. 15–18; the entire article, which includes other sections by Emily MacFarquhar and Brian Beedham, gives an excellent warts-and-all sketch of the Chinese economy.

[28] Ashbrook, JEC–75, pp. 42–45.

In the author's judgment, both the imminent appearance of the new accounts and the small expected gain in precision argue against any attempt on his part to refine the simplified GNP accounts, for example, by introducing separate transportation and trade sectors, by tackling the problem of handicraft production, or by introducing additional agricultural commodities. The calculations, as set forth in table 3, thus retain the same formidable simplicity of prior versions. In brief, an agricultural production index based on grain and cotton is combined with Field's industrial production index on the basis that agriculture and related activity were twice the size of industrial and related activity in 1957. The resulting GNP index series is turned into a series in 1977 U.S. dollars through (a) use of the relationship between Chinese GNP in 1955 calculated in yuan and Chinese GNP in 1955 calculated in dollars, and (b) use of the U.S. GNP price deflator for 1977.

TABLE 3—CHINA: LINE ITEMS IN CALCULATION OF GNP, 1949–77[1]

	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
1. Grain (mllion metric tons)	111	130	141	161	164	166	180	188	191	206	171	156	168	180	190
2. Grain index (1957=100)	58.12	68.06	73.82	84.29	85.86	86.91	94.24	98.43	100.00	107.85	89.53	81.68	87.96	94.24	99.48
3. Food production index (1957=100)	58.12	68.06	73.82	84.29	85.86	86.91	94.24	98.43	100.00	107.85	84.55	77.14	83.07	94.24	99.48
4. Cotton (million metric tons)	.44	.69	1.0	1.3	1.2	1.1	1.5	1.4	1.6	1.7	1.2	.9	.8	1.0	1.2
5. Nonfood production index (1957=100)	27.50	43.13	62.50	81.25	75.00	68.75	93.75	87.50	100	106.25	75.00	56.25	50.00	62.50	75.00
6. Food index times 0.85	49.40	57.85	62.75	71.65	72.98	73.87	80.10	83.66	85.00	91.68	71.87	65.57	70.61	80.10	84.55
7. Nonfood index times 0.15	4.13	6.47	9.38	12.19	11.25	10.31	14.06	13.13	15.00	15.94	11.25	8.44	7.50	9.38	11.25
8. Agricultural production index (1957=100)	53.52	61.32	72.12	83.84	84.23	84.19	94.17	96.79	100.00	107.61	83.12	74.00	78.11	89.48	95.80
9. Agricultural index times 2	107.05	128.64	144.25	167.67	168.47	168.37	188.33	193.58	200.00	215.23	166.24	148.01	156.22	178.96	191.61
10. Industrial production index (1957=100)	19.95	27.44	37.53	48.00	60.57	70.39	72.51	88.44	100.00	142.09	172.58	181.37	104.74	111.02	134.02
11. Line 9 plus line 10	127.00	156.08	181.78	215.67	229.04	238.76	260.84	282.02	300.00	357.32	338.82	329.38	260.96	289.98	325.63
12. GNP index (1957=100)	42.33	52.03	60.59	71.89	76.35	79.59	86.95	94.01	100.00	119.11	112.94	109.79	86.99	96.66	108.54
13. GNP (billion 1977 U.S. dollars)	54.37	66.83	77.83	92.34	98.06	102.23	111.68	120.75	128.44	152.98	145.07	141.02	111.73	124.15	139.42
14. Population, midyear (million persons)	537.9	547.4	558.1	569.9	582.6	596.0	610.2	625.1	640.2	655.2	669.7	683.1	694.6	707.0	721.8
15. GNP per capita (1977 U.S. dollars)	101.08	122.08	139.45	162.03	168.32	171.52	183.02	193.16	200.63	233.49	216.61	206.44	160.85	175.61	193.15
16. Index of per capita GNP (1957=100)	50.38	60.85	69.51	80.76	83.89	85.49	91.22	95.28	100.00	116.38	107.97	102.90	80.17	87.53	96.27
17. Grain production per capita (kilograms)	206.36	237.47	252.64	282.51	281.50	278.52	294.99	300.75	298.34	314.41	255.34	228.37	241.87	254.60	263.23
18. Index of per capita grain production (1957=100)	69.17	79.60	84.68	94.69	94.35	93.36	98.87	100.81	100.00	105.38	85.59	76.55	81.07	85.34	88.23

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
1. Grain (million metric tons)	194	194	215	225	210	215	243	246	240	266	275	284	285	285
2. Grain index (1957=100)	101.57	101.57	112.57	117.80	109.95	112.57	127.23	128.80	125.65	139.27	143.98	148.69	149.21	149.21
3. Food production index (1957=100)	101.57	101.57	112.57	117.80	109.95	112.57	127.23	128.80	125.65	139.27	143.98	148.69	149.21	149.21
4. Cotton (million metric tons)	1.7	1.9	1.8	1.9	1.8	1.8	2.0	2.2	2.1	2.5	2.5	2.3	2.3	2.4
5. Nonfood production index (1957=100)	106.25	118.75	112.50	118.75	112.50	112.50	125.00	137.50	131.25	156.25	156.25	143.75	143.75	150.00
6. Food index times 0.85	86.34	86.34	95.68	100.13	93.46	95.68	108.14	109.48	106.81	118.38	122.38	126.39	126.83	126.83
7. Nonfood index times 0.15	15.94	17.81	16.88	17.81	16.88	16.88	18.75	20.63	19.69	23.44	23.44	21.56	21.56	22.50
8. Agricultural production index (1957=100)	102.27	104.15	112.56	117.94	110.33	112.56	126.89	130.10	126.49	141.81	145.82	147.95	148.39	149.33
9. Agricultural index times 2	204.55	208.30	225.11	235.89	220.66	225.11	253.78	260.20	252.99	283.63	291.64	295.90	296.79	298.66
10. Industrial production index (1957=100)	161.07	198.76	231.83	202.44	221.23	265.54	316.23	349.16	384.73	436.08	454.89	501.81	501.81	572.06
11. Line 9 plus line 10	365.62	407.06	456.94	438.33	441.89	490.65	570.01	609.36	637.72	719.71	746.53	797.71	798.60	870.72
12. GNP index (1957=100)	121.87	135.69	152.31	146.11	147.30	163.55	190.00	203.12	212.57	239.90	248.84	265.90	266.20	290.24
13. GNP (billion 1977 U.S. dollars)	156.54	174.28	195.64	187.67	189.19	210.07	244.05	260.90	273.04	308.14	319.62	341.54	341.92	372.80
14. Population, midyear (million persons)	737.5	754.0	771.1	788.7	807.3	826.6	846.6	866.7	886.4	905.7	924.4	943.0	962.3	982.5
15. GNP per capita (1977 U.S. dollars)	212.25	231.14	253.71	237.95	234.35	254.14	288.27	301.02	308.03	340.22	345.76	362.18	355.31	379.44
16. Index of per capita GNP (1957=100)	105.79	115.21	126.46	118.60	116.81	126.67	143.68	150.04	153.53	169.58	172.34	180.52	177.10	189.12
17. Grain production per capita (kilograms)	263.05	257.29	278.82	285.28	260.13	260.10	287.03	283.84	270.76	233.70	297.49	301.17	296.17	290.08
18. Index of per capita grain production (1957=100)	88.17	86.24	93.46	95.62	87.19	87.18	96.21	95.14	90.75	98.44	99.71	100.95	99.27	97.23

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[1] Because of rounding, data may not add to the total shown.

The updated series adds 3 more years, 1975–77. Because the prior series was in 1973 dollars, the updated series incorporates the results of 4 more years of inflation, 1974–77. The U.S. price deflator for 1977 is 33.6 percent higher than the deflator for 1973 and represents a substantial change in the measuring rod.

Although the methodology for calculating the series is unchanged, the substantive estimates entering into the components have continued to be examined on the basis of fragmentary new data. First, the grain estimates have been slightly modified on the basis of new information and the use of a somewhat different definition. Second, the most recent version of Field's industrial production index has been incorporated.

The meaning and origin of the 18 line items in table 3 are as follows:

Line 1.—The series for grain production was taken from the draft of a forthcoming journal article,[29] which incorporates a review of all information on both the definition and the level of grain production. The definition of grain for this series has been changed in two respects compared with the definition used in JEC–75: (a) Grain now includes soybeans, and (b) potatoes are converted to grain equivalents by taking one-fifth (the current Chinese practice) rather than one-fourth their weight. The result of this definitional change is that grain production in the base year 1957, for example, is now carried at 191 million metric tons instead of the long familiar 185 million metric tons.

Line 2.—The grain index was derived from line 1 by setting the value for 1957 equal to 100.

Line 3.—The food production index was taken as identical to the grain index for all years except the years that the Chinese themselves call the 3 disaster years, 1959–61. Grain production was assumed to be 85 percent of toal production in all years, except 1959–61, when it is assumed to be 90 percent. This assumption is based on (a) the estimated impact on the production of nongrain foods of the crackdown on private plots in these years, and (b) an unpublished analysis of ration data for Chinese refugees, which suggests a reduction in the availability of nongrain foods of this proportion.

Line 4.—The series for cotton production was taken from a U.S. Government study.[30] A value for the year 1977 was added to the series by the author, at a level slightly above 1976, on the basis of (a) Chinese claims of an unspecified increase and (b) the increase of inputs, especially of fertilizer.

Line 5.—The nonfood agricultural production index was obtained from line 4 by letting cotton stand for the whole category and setting the value for 1957 equal to 100.

Line 6.—The food production index of line 3 was multiplied by 0.85. An unpublished calculation [31] of some time back showed that the internal yuan value of the food portion of agricultural production was approximately 85 percent of the total value of agricultural production, with the nonfood portion being 15 percent.

Line 7.—The nonfood production index of line 5 was multiplied by 0.15.

Line 8.—Lines 6 and 7 were added to get an agricultural production index.

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[29] Robert Michael Field and James A. Kilpatrick, "Chinese Grain Production: An Interpretation of the Data" (scheduled for publication in China Quarterly, No. 73, March 1978).

[30] Central Intelligence Agency, "China: Economic Indicators." ER 77–10508, October 1977, p. 11.

[31] Mentioned in Ashbrook, JEC–72, p. 42.

Line 9.—The agricultural production index of line 8 was multiplied by 2.[32]

Line 10.—The value-added industrial production index of Robert Michael Field was used, as updated. Since the JEC–75 volume, Field has added the year 1975 to his series and has made estimates for a new commodities for 1976–77. He has extended the index through 1977 based on his extensive investigation of gross value of industrial output figures, both national and provincial.

Line 11.—Lines 9 and 10 were added.

Line 12.—Line 11 was divided by 3 to obtain a GNP index, with 1957=100.

Line 13.—The index of line 12 was turned into a GNP series in 1977 U.S. dollars by first taking the value of Chinese GNP in 1955 of $48.19 billion [33] and multiplying by 2.3175, the ratio of the U.S. GNP deflator index in 1977 (141.32) to the deflator in 1955 (60.98);[34] this gave a value of $111.68 billion for Chinese GNP for 1955 in 1977 U.S. dollars; the index in line 12 was then multiplied by $111.68 divided by 86.95.

Line 14.—The population series is the series used by John S. Aird in his article in the present volume.

Line 15.—The per capita GNP series was derived by dividing line 13 by line 14.

Line 16.—The per capita GNP index series was derived from line 15 by setting the value for 1957 equal to 100.

Line 17.—The per capita grain series was derived by dividing line 1 by line 15.

Line 18.—The per capita grain index series was derived from line 17 by setting the value for 1957 equal to 100.

APPENDIX B. SOURCES OF INFORMATION ON THE CHINESE ECONOMY

Official economic data on China have remained in short supply ever since the statistical blackout was imposed in 1960. The last three yearend press releases on economic results have been thinner gruel, if anything, than the vague announcements of the early 1970's. The reader has been given a few percentage growth claims for crops, industrial commodities, or provinces that did especially well, with qualitative descriptions normally serving for those that did less well. These percentages in many instances could be tied back to absolute quantities in base periods, although the usual care has had to be taken to identify the scope of the claim (whether, for example, it applied to both modern and handicraft industry) and changes in definition. Furthermore, or so at least the Hua regime now claims, statistical reporting in 1975–77 was sometimes falsified through the machinations of the Gang of Four. At a minimum, the lack of strong guidance from the center and the intensified fear of management at all levels to report bad news probably led to a deterioration in the accuracy of statistical reporting over the last 3 years.

In his February 1978 report on the work of the government, Chairman Hua took the unusual step of announcing a few figures for the

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[32] For the rough-hewn calculation that agriculture-related activity was twice industry-related activity in 1957, see Ashbrook, JEC–72, p. 42.

[33] Ashbrook, JEC–72, pp. 42–43.

[34] Economic Report of the President, January 1978, Washington, Government Printing Office, Table B–3, p. 260.

1976–85 plan: The grain and steel targets for 1985; the planned growth rates for industry, agriculture, and population; and the number of planned large-scale construction projects.[35]

As for qualitative information about recent developments in the economy, press reports containing the charges of the ideologues and the modernizers sometimes have been of help in understanding problems in the administration of factories and communes, the selection of cadres for higher posts, the screening of applicants for universities and technical schools, the use of foreign machinery and equipment in the economy, and the distribution of consumer goods in short supply. These reports have had to be weighed carefully because they were surfaced for political rather than informational purposes, and many were the winners' *ex post* accounts of the struggle.

In addition to official releases, reports of travelers, newspapermen, diplomats, businessmen, technicians, and overseas Chinese have continued as a leading source of information on the PRC economy. This highly variegated source must be used with caution, since the Chinese Government usually admits only those visitors who are at least sympathetic to the regime; it controls the itinerary and movements of its guests, the pattern of control varying according to the guest's identity, his political coloration, and the use Peking feels it can make of the visit at that particular point in time. As the numbers and kinds of visitors increases, and as second and third visits are made, the efforts to screen off what the authorities would prefer not be seen or heard gradually become less effective. Furthermore, the overthrow of the Gang of Four has restored the trend toward increasing contact by a growing number of Chinese with foreign businessmen, technicians, and scientists, including dismal scientists. Chinese officials now have a much greater chance of visiting Houston to discuss oil-drilling equipment or of reading a foreign journal article on modern coal-mining techniques. This expanded contact, of course, is a two-way street and helps the China watcher understand the problems of economic planning and development in the People's Republic.

As for other sources, refugees have continued to furnish nitty-gritty details of life in the cities, towns, and villages of China, but the importance of this information has diminished as information from other sources has grown in volume. The Soviets have lost the unique advantage they had in the 1950's in studying the Chinese economy. They seem to have allowed their economic coverage of the People's Republic to have fallen into disrepair and to have only recently stepped up efforts in this field. Extensive data on China's foreign trade, published by both Communist and non-Communist trading partners, remain the single greatest source of "hard" information on the Chinese economy.

The Western scholars writing on the PRC have gradually deepened their understanding of what is transpiring in the Middle Kingdom, even though an enormous amount of work remains to be done. Ranking at or near the top of any list of books dealing with Chinese political economy of the present era are Prof. Ross Terrill's two volumes, "800,000,000: The Real China" and "Flowers on an Iron Tree."[36]

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[35] Peking, NCNA, Mar. 6, 1978 (FBIS-CHI-78-52-Supp., Mar. 16, 1978, pp. 14, 19,27)

[36] Boston, Little, Brown, 1971 and 1975, respectively.

A valuable book, because it is one of the small number offsetting a host of uncritical accounts, is "Chinese Shadows" by Simon Leys.[37] The pseudonymic Leys deplores the way in which Mao's Government has screened off the Chinese people from an appreciation of their history and culture in a manner reminiscent of Orwell's "1984." The Economist article of late 1977, cited above, [38] is a further illustration of the ability of certain visitors to offer shrewd insights or suggestions about the economy even when constrained in their movements. "China's Economic Revolution" by the late Prof. Alexander Eckstein[39] provides an authoritative appraisal of general Chinese economic trends through 1975. As an example of work being done in piecing together the fragmentary quantitative data from the people's Republic, Field, Lardy, and Emerson have done yeoman work in taking provincial data on the gross value of industrial output (GVIO) and reconciling it with national data.[40]

In summary, the economist-observer still must work with fragmentary information on China and still must obtain many of his insights through reading between the lines of official press reports. Currently, the amount of economic information available is increasing as the Hua Government softens the xenophobic policies of recent years and as China resumes the long-term trend of gradually rising involvement in international economic affairs. Nonetheless, the government shows no immediate signs of permitting the release of the several dozen national industrial and agricultural series that made the 1950's the golden age of Chinese economic statistics.

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[37] New York, Viking Press, 1977, original French edition, 1974;

[38] See footnote 27.

[39] New York, Cambridge University Press, 1977;

[40] For an example of their work, see Robert Michael Field, Nicholas R. Lardy, and John Philip Emerson: "A Reconstruction of the Gross Value of Industrial Output by Province in the People's Republic of China, 1949-73." Foreign Economic Reports, No. 7, Foreign Demographic Analysis Division, U.S. Department of Commerce, Washington, 1975.

Part II. MANUFACTURING AND EXTRACTIVE INDUSTRIES

POLITICAL CONFLICT AND INDUSTRIAL GROWTH IN CHINA: 1965–1977

By Robert Michael Field, Kathleen M. McGlynn, and William B. Abnett

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Abbreviations

BBC	British Broadcasting Corp., *Summary of World Broadcasts*, part 3, The Far East, Weekly Economic Report, and its preceecessors.
CCP	Chinese Communist Party.
FBIS	Foreign Broadcast Information Service, *Daily Report, People's Republic of China*, and its predecessors.
Field, Lardy, and Emerson, 1976	Field, Robert Michael, Lardy, Nicholas R., and Emerson, John Philip, *Provincial Industrial Output in the People's Republic of China: 1949–75*, Foreign Economic Report No. 12, U.S. Department of Commerce, Washington, D.C., 1976.
GVIO	Gross value of industrial output.
JMJP	*Jen-min jih-pao* (*People's Daily*).
JPRS	U.S. Joint Publications Research Service.
Learn from Taching	*Chien-ch'ih tang-ti chi-pen lu-hsien tsai tou-cheng chung hsüeh ta-ching* (*Uphold the Basic Party Line in the Movement to Learn from Taching*), Peking, 1977.
NCNA	New China News Agency.
PLA	People's Liberation Army.
TKP (HK)	*Ta-kung pao* (*The Impartial*) (Hong Kong).
"Twenty Points"	"Some Problems in Speeding Up Industrial Development," draft dated September 2, 1975; translated in *Issues and Studies*, vol. XIII, No. 7, 1977.

I. Introduction

Today, when the Chinese are determined to build a strong, modern nation, the outlook for industrial performance is of concern not only to China specialists but also to policymakers, businessmen, and all who are interested in the lives and fortunes of the nearly 1 billion Chinese people. Since the rehabilitation of Teng Hsiao-p'ing, the Chinese have been quite open in discussing their past shortcomings and current problems, but they have not given us data in the form necessary for an assessment of industrial performance. Therefore, following the work that Field did with Lardy and Emerson,[1] we have gathered scattered statements about the growth of the gross value of industrial output (GVIO) for individual provinces in order to reconstruct the GVIO data for each of the 29 provinces and for the country as a whole.[2] The pattern and rates of growth shown by the data are then analyzed in the light of the economic and political problems of the last decade.

The GVIO data published or broadcast by the Chinese are difficult to use. First, the data are a mixture of estimates made before the end of the year, final figures, and subsequent revisions that are seldom explicitly identified; even data from a single source are sometimes inconsistent. Consider, for example, the following figures for Kwangtung:[3]

	Original	Revised
Previous year=100:		
1974		107.4
1975	115.19	115.6
1976	105.9	106.4
1973=100:		
1976		131.56

Here, the revisions are small and appear to be reasonable, and the inconsistency between the annual increases and the growth for the 3 years as a whole is minor.

Second, in the last year or two the Chinese have been careless in handling statistical data and, in particular, in translating them into English. The most frequent source of error has been in the translation of the character *pei*. For example, a *Ta-kung pao* English-language supplement dated September 15, 1977, reported that "[Shanghai's] total industrial output value is now more than 11 times what it was immediately after liberation," whereas it is clear from other statements that output was actually 19.3 times that of 1949.[4] The original Chinese was probably *shih to pei* (which literally means "an increase of more than 10 times over" and by accepted usage "an increase of 10 to 20 times over" the value in the specified base period). Just as a twofold increase is three times, a tenfold increase is 11 times. Thus, the Chinese was incorrectly translated as "more than 11 times" (which means 11 to 12 times). In this case, the cause of the error could be deduced, but more frequently isolated figures that do not fit into the larger body of data cannot be explained.

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[1] Robert Michael Field, Nicholas R. Lardy, and John Philip Emerson, *Provincial Industrial Output in the People's Republic of China: 1949–75*, Foreign Economic Report No. 12, U.S. Department of Commerce, Washington, D.C., 1976.

[2] Provincial GVIO series for the years 1965–77 are presented in table C–1. For sources and methodology, see CIA, "The Gross Value of Industrial Output in the People's Republic of China: 1965–77," June 1978. Throughout this article, the term "province" includes the five autonomous regions and the three directly administered municipalities.

[3] The original figures are cited in FBIS, Jan. 16, 1976, H1, and FBIS, Jan. 26, 1977, H2; the revised figures are in "Learn from Teaching," p. 67.

[4] FBIS, Dec. 8, 1977, E5.

Even after the practical problems with the GVIO data are sorted out, certain theoretical shortcomings still remain. The basic problem stems from the Chinese use of the "factory reporting method" to measure the value of industrial output.[5] This method introduces a substantial amount of double counting, which may affect the gross value of output in a number of ways. First, because the value of output reported by each enterprise includes the costs of purchased raw materials and semifinished inputs, changes in the organization of the industrial sector can either raise or lower the aggregate GVIO. For example, increased specialization of production tends to inflate GVIO (because more semifinished inputs are purchased and the degree of double accounting is increased), whereas mergers that combine enterprises in different stages of production into a single accounting unit tend to lower GVIO, as for example, in the iron and steel and coal industries.

Second, the use of the factory reporting method can also distort the data over time. Consider, for example, the following indexes for 1976 (with 1965=100):[6]

Crude oil output	770
Natural gas output	920
Crude oil processing capacity	570
GVIO of the petroleum industry	520

The difference between the growth of crude oil processing capacity and crude oil output is easily explained by crude oil exports and the growing use of crude oil as a fuel. The GVIO index, however, is hard to understand. According to Chinese statistical practice, the GVIO of the petroleum industry should be the value of the crude oil sold plus the value of the refined products sold plus the value of all other sales. Thus, it would seem that the GVIO index should have been much higher than 520.

Despite these practical and theoretical difficulties, the reconstructed GVIO data show the same pattern of growth as a value-added index based on physical output data for 42 commodities produced by 11 branches of industry (see table 1). Moreover, the GVIO data offer several distinct advantages over the value-added index. First, there is a large body of reasonably consistent GVIO data for 1976–77, while the few physical output estimates that are available need to be revised and brought up to date in the light of recently released but still fragmentary information. Second, the GVIO data allow an examination of the geographic pattern of growth. And finally, when used in conjunction with statements on the share of the plan fulfilled at various times during the year, the data make possible an examination of the pattern of growth within the year. For these reasons, the quantitative judgments in this article are based on the provincial GVIO data and the national figures derived from them.

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[5] For a detailed description of the factory reporting method, see Robert Michael Field, Nicholas R. Lardy, and John Philip Emerson, *A Reconstruction of the Gross Value of Industrial Output by Province in the People's Republic of China: 1949–75*, Foreign Economic Report No. 7, U.S. Department of Commerce, Washington, D.C., 1975.

[6] JMJP, Aug. 14, 1977.

Section II provides a brief survey of China's industrial performance since the Cultural Revolution and outlines the regional development policies followed by the Chinese since the 1950's. Section III examines the interplay of political conflict and industrial performance in 19 provinces during the mid-1970's to test a commonly suggested hypothesis that declines in industrial production are closely linked to political instability. Section IV compares the relative impact of political turbulence on industrial performance during the two periods of greatest instability since 1949; namely, the Cultural Revolution (1966–69) and the struggle for succession (1974–77). Finally, in section V the steps taken by the post-Mao leadership to spur economic modernization after a decade of political and economic instability are outlined, with emphasis on the Hua administration's current strategy for industrial development. Statistical data and methods of political analysis are printed in the appendixes.

II. Industrial Performance

A. Growth Rates

Estimates of industrial production for the years 1965–77 are presented in table 1. By 1965, industry had recovered from the collapse that followed the Leap Forward (1958–60), and most major commodities were being produced at earlier peak levels. However, the Third 5-Year Plan period (1966–70) was soon interrupted by the turmoil of the Cultural Revolution. Work stoppages, shortages of raw materials, and disruptions of transportation forced industrial production below the 1966 level in both 1967 and 1968. No accurate measure of the decline in production can be made from available data, but it probably was on the order of 15 percent in 1967. Production remained at low levels at least through the first half of 1968, and then began to recover rapidly. By 1969, it exceeded the pre-Cultural Revolution peak of 1966, and in 1970 went on to grow by more than 20 percent. The average annual rate of growth for the Third Five-Year Plan as a whole was 11.7 percent.

TABLE 1.—INDUSTRIAL PRODUCTION IN THE PEOPLE'S REPUBLIC OF CHINA, 1965–77

	Gross value			Value added	
	Billion 1957 yuan	Index (1965=100)	Annual percentage change	Index (1965=100)	Annual percentage change
1965	139.3	100		100	
1966	175.9	126	26.3	117	16.5
1967	147.2	106	−16.3	102	−12.9
1968	154.7	111	5.1	111	9.4
1969	197.3	142	27.5	134	20.4
1970	242.2	174	22.8	159	18.8
1971	267.5	192	10.5	175	10.4
1972	295.4	212	10.4	193	10.3
1973	326.0	234	10.3	219	13.2
1974	340.6	245	4.5	229	4.4
1975	374.3	269	9.9	252	10.3
1976	382.7	275	2.2		
1977	436.3	313	14.0		

Sources: Gross value: CIA, "The Gross Value of Industrial Output in the People's Republic of China: 1965–77," June 1978.

Value added: CIA, "China: Economic Indicators," October 1977. The derivation of the index is described in Robert Michael Field, "Industrial Production in the People's Republic of China: 1949–74," in Congress of the United States, Joint Economic Committee, China: A Reassessment of the Economy, Washington, D.C., 1975, pp. 160–174.

After rapid increases in 1969 and 1970, the growth of industrial output in the Fourth 5-Year Plan period (1971–75) fell off markedly as production pushed up against capacity. During the early 1960's investment in industry had been limited primarily to the completion of projects started in the late 1950's. By 1964 or 1965, a broader construction program appears to have been started. During the Cultural Revolution, however, when the production of steel, cement, and timber was down and transportation was often disrupted, construction work suffered. Finally, during the Fourth 5-Year Plan period, new capacity was not being added rapidly enough to sustain the high rate of growth attained during the previous 5 years. In addition, shortages of coal, iron ore, and other basic raw materials began to affect production of both producer and consumer goods. These shortages reflected fundamental imbalances in extractive, processing, and finishing industries.

Poor performance in agriculture also forced major changes in priorities in 1972 and 1973. Whatever the initial goals of the Fourth 5-Year Plan, it is clear that the revisions gave increased priority to industrial support of agriculture and to expansion of exports. Thus, Peking had to defer grappling with the structural imbalances that were holding down the growth of industry.

These fundamental economic problems were soon complicated by a new wave of political turmoil. As Mao grew old and frail, the struggle for succession broke into the open. The campaign to criticize Lin Piao and Confucius (late 1973–74) quickly made itself felt throughout industry. Production dropped far below planned output and by midyear 1974 the situation was serious enough for the Central Committee to issue directive No. 21, which focused on economic difficulties caused by the excesses of the political campaign.[7] The Central Committee stated specifically that the production of coal in the first 5 months of 1974 was 8.35 million tons short of the national target and that the shortage of coal had affected major rail lines and a long list of industries including iron and steel, nonferrous metals, chemical fertilizer, and cement. The situation improved in the fall when Peking applied the brakes to the campaign to criticize Lin Piao and Confucius, but the rate of growth for the year was only 4.5 percent.

The year 1975 began on an upbeat, with Premier Chou En-lai making a key speech to the Fourth National People's Congress in January, calling for a vigorous modernization of the economy.[7a] During the first half of the year, the industrial sector responded well to positive actions taken by the Government to restore order in the wake of the campaign to criticize Lin Piao and Confucius. Numerous economic conferences were held, most notably the national railway conference in March; and strong measures, such as the deployment of troops to faction-ridden Hangchow, were ordered. Nevertheless, the lack of strong production claims from such critical sectors as electric power and iron and steel suggest that the rate of industrial growth tapered off during the year and that any gains were largely based on recovery in the most disrupted areas and enterprises. Moreover, structural imbalances and transportation bottlenecks continued to plague industry. In short, the year was marked by a spurt during the first 6 months followed by a gradual slowdown during the second half. The rate of growth was 10 percent for 1975 and averaged 9.1 percent annually for the Fourth 5-Year Plan period as a whole.

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[7] New York Times, Nov. 15, 1974, p. 3.
[7a] *Peking Review*, No. 4, 1975, pp. 21-25.

The prospects for real progress in 1976 were shattered by the death of Premier Chou En-lai in January, which led to the intensification of the struggle for succession. The raging political storm did not have an immediate impact on industry. During the first quarter, output increased 13 percent over the corresponding period of 1975. But industry faltered during the second quarter, and collapsed in the third. The collapse was made worse by the devastating Tangshan earthquake in July which leveled the city of Tangshan, caused major damage in Tientsin and was felt as far away as Peking. More than 650,000 people were reported killed and billions of dollars' worth of damage was done; moreover, relief and reconstruction preempted normal production and construction activity in other areas of the country.

The death of Chairman Mao in September was quickly followed by the purge of the "gang of four" in early October. And later that month, the Central Committee issued central directive No. 19,[8] which called for strong measures against slowdowns and absenteeism and for a careful accounting of funds available for investment. In spite of these positive actions, industrial production for the year as a whole grew only slightly more than 2 percent.

Peking hoped that 1977—the first full year following the purge of the radicals—would show a healthy recovery and provide a firm basis for accelerated growth during the remainder of the Fifth 5-Year Plan period. Performance in January and February was erratic but then improved month by month. However, progress apparently fell short of the leadership's expectations. It appears that those economic problems stemming from factional maneuvering were unexpectedly difficult to solve and shortages of raw materials and electric power made it impossible for many plants to operate anywhere near capacity.

Dissatisfaction with the pace of recovery probably figured in the decision in July to reappoint Teng Hsiao-p'ing to his posts in the government and party. And it is certainly reflected in State Planning Commission Chief Yü Ch'iu-li's statement in late October to party and state cadres that, although "the tide was turning" on the economic front, many difficulties remained. He emphasized that, because of severe bottlenecks and the generally chaotic situation, China's economic problems "cannot be solved in 1 year." Although the 14-percent rate of industrial growth in 1977 was impressive, it reflected recovery from the poor performance in the second half of 1976 as much as the continued moderate improvement in the third and fourth quarters of the year.

B. *Regional Structure*[9]

The historical process of development had resulted in a highly uneven geographical distribution of industrial capacity at the time the Communists came to power despite the fact that China's natural resources are well dispersed. Capacity was concentrated in Northeast, North, and East China, where a combination of relative political stability, a developed transport system, readily available agriculture and industrial raw materials, and large markets had attracted foreign capital. Smaller industrial centers had developed in several provinces where enterprising warlords had built small industrial complexes, and in Southwest China during World War II when industrial plant and equipment were removed from coastal cities in the face of advancing Japanese armies. More than three-fourths of total industrial production in 1952 originated in the three relatively well-developed regions.

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[8] *Issues and Studies*, vol. XIII No. 2, 1977, p. 12.

[9] The post-Mao leadership has divided China into six great regions, as follows:
Northeast: Heilungkiang, Kirin, Liaoning.
North: Peking, Tientsin, Hopeh, Shansi, and Inner Mongolia.
East: Shanghai, Shantung, Kiangsu, Chekiang, Anhwei, Kiangsi, and Fukien.
Central-South: Honan, Hupeh, Hunan, Kwangsi, and Kwangtung.
Northwest: Kansu, Shensi, Ningsia, Tsinghai, and Sinkiang.
Southwest: Szechwan, Yunnan, Kweichow, and Tibet.

Faced with this unbalanced distribution of industrial capacity the new Communist regime undertook a deliberately phased policy of regional development. The specific provisions governing the geographical distribution of industrial capital construction were as follows: (1) expansion of existing industrial bases, especially in northeast China, in order to support the construction of new industrial areas; (2) construction of new industrial bases in North and Central China, centering around two new iron and steel complexes to be built in Pao-t'ou and Wu-han; and (3) the construction of a new industrial base in Southwest China.

During the First 5-Year Plan period (1953–57), central and western China and the less industrialized areas in North China developed most rapidly, and growth in East China was the slowest. The indexes in table 2 show that with the exception of the Southwest the pattern of growth has remained the same during the last 20 years. Even so, the Northwest (which has grown the most rapidly) made the smallest absolute contribution to the growth of industrial output while the East made by far the largest. The rate of growth in the Southwest must have been a major disappointment to the Chinese. Although a large number of large-scale construction projects have been completed (especially in Szechwan), the Southwest has been the slowest growing region in China since 1957.

TABLE 2.—GROWTH OF INDUSTRIAL PRODUCTION, BY REGION, 1957–77

	Relative increase		Absolute increase		
	1977 index (1957=100)	Rank	Billion 1957 yuan	Percent	Rank
Total	632		365.9	100	
Northeast	522	5	65.9	18	3
North	836	2	78.5	21	2
East	609	4	124.6	34	1
Central-south	652	3	54.3	15	4
Northwest	928	1	19.8	5	6
Southwest	492	6	22.6	6	5

Source: Field, Lardy, and Emerson, 1976, p. 20, and table C–2.

The new post-Mao leadership has reaffirmed the regional development policies of the last 25 years by establishing six great regions which are intended to function "self-reliantly while working in close coordination [with each other]" and to have "a fairly harmonious development of agriculture and light and heavy industry [within the region]." It is not yet clear what kind of administrative structure the regions will have, or how free they will be to plan and manage their respective economies, or even whether they will accelerate or retard the flow of resources from the more developed to the less developed areas.

In any case, the gestation period for investment in relatively undeveloped regions seems to have been much longer than the Chinese had hoped. By 1985 the investment in the Southwest probably will have begun to pay off, but the regional distribution of production is not likely to have changed significantly. The data in table 3 show how slow and difficult the process has been.

TABLE 3.—DISTRIBUTION OF CHINESE INDUSTRIAL PRODUCTION, BY REGION, 1957, 1965, 1970, AND 1977

	1957	1965	1970	1975	1977
Total	100.0	100.0	100.0	100.0	100.0
North	22.7	22.3	20.1	18.6	18.8
Northeast	15.5	18.0	20.2	21.5	20.5
East	35.6	34.1	33.8	33.7	34.3
Central-south	14.3	14.0	14.5	14.7	14.8
Northwest	3.5	4.6	5.2	5.0	5.1
Southwest	8.4	6.9	6.2	6.4	6.5

Sources: 1957: Field, Lardy, and Emerson, 1976, p. 20. 1965, 1970, 1975, and 1977: Table C-2.

III. THE INTERPLAY OF PROVINCIAL POLITICS AND INDUSTRIAL GROWTH, 1974–77

> The Wuhan Iron and Steel Company was directly affected by the "gang of four." . . . They ruthlessly persecuted the cadres and masses and sabotaged revolution and production. In the three years of 1974–1976 they caused the Wuhan Iron and Steel Company to lose one and one-half year's output. [9a]
>
> Under the leadership of the Kiangsi tractor plant . . . the masses . . . have overcome all difficulties and, in a week, completely resumed production, ending eight months of production stoppage caused by the "gang of four." [9b]
>
> Due to the interference and sabotage by the "gang of four," the [Kiangsi Tractor] plant produced some 10,000 tractors less for the state in the past three years.[9c]
>
> . . . the "gang of four" struck its nose into the Hangchow silk-printing and dyeing plant . . . The result was a split among the cadres, workers, and staff members, forcing the plant several times to suspend its production or operate at half capacity and inflicting great losses on the party and state.[9d]

The close relationship between political stability and economic performance is especially striking in China's industrial sector. During periods of relative political stability such as 1970–73, the growth of Chinese industrial output has been impressive. However, the rate of growth has fallen off dramatically in times of political infighting, such as during the struggle for succession (1974–77).[10] China specialists have hypothesized that the existence of factionalism—a manifestation of political instability—during periods of intense political conflict leads to the mobilization of workers who participate in disruptive activities to discredit their faction's opponents.[10a] The more disruptive the factional conflict, the more serious the damage to industrial production. This section examines in detail the nature of the relationship between political conflict and industrial growth in the 19 provinces for which GVIO data were available for each of the years 1974–77.[11]

[9a] FBIS, Jan. 12, 1978, H5.

[9b] FBIS, Nov. 8, 1976, G4.

[9c] FBIS, Dec. 2, 1976, G6.

[9d] FBIS, Nov. 18, 1976, G1.

[10] The period 1974–77 gave rise to 3 major political campaigns: The campaign to criticize Lin Piao and Confucius (late 1973–74), the campaign to criticize Teng Hsiao-p'ing (1976), and the campaign to criticize the "gang of four" (October 1976 to date).

[10a] For example: Field, Lardy & Emerson, pp. 16–17; and Carl Riskin, "China's Economy: At the Cross Roads Yet Again?" *Contemporary China* vol. 1, No. 3, pp. 2–3.

First, GVIO trends for the years 1965–77 were calculated for the 19 provinces, in most cases using the years 1965–66 and 1970–73 (which were relatively stable both politically and economically) to establish the trend. For a number of provinces, different combinations of years were chosen in order to include the most stable years.[12]

Once the trends were tailored to each province, the GVIO growth rates for the years of political turmoil (1974 and 1976) were compared with the trend growth rates and each province assigned a score ranging from −6 for a decline in GVIO in both years to +6 for growth greater than trend in both years. Next, the provinces were ranked according to their relative political stability during the period 1974–77 and assigned scores ranging from −6 for unstable, politically factionalized provinces to +6 for politically stable provinces.[13]

Finally, the two scores were plotted with the political stability index on the horizontal axis and the GVIO growth rate index on the vertical axis. Figure 1 presents the results, placing the provinces in their approximate order. We found a strong correlation between political stability and industrial growth in the 19 provinces examined,[14] corroborating the hypothesis that factional infighting leads to declines in industrial production. Correlation does not prove causality; transportation problems in neighboring provinces or national decisions on the allocation of resources certainly can have an impact on provincial growth rates. As the following quadrant-by-quadrant analysis shows, however, no explanation of provincial economic performance is complete without a careful consideration of political factors.

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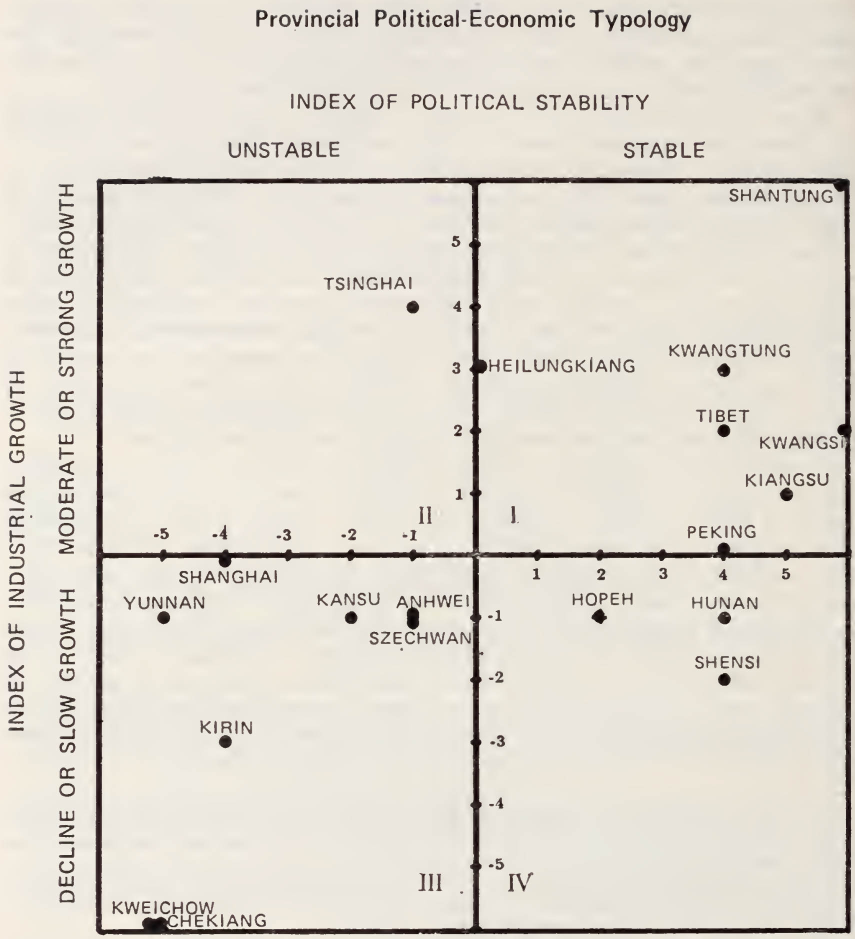
[11] The provinces are Anhwei, Chekiang, Heilungkiang, Hopeh, Hunan, Kansu, Kiangsu, Kirin, Kwangsi, Kwangtung, Kweichow, Peking, Shanghai, Shantung, Shensi, Szechwan, Tibet, Tsinghai, and Yunnan. Data on monthly industrial output for 15 of these and 7 other provinces are presented in app. B, and annual GVIO series for all 29 provinces are presented in app. C.

[12] The provinces for which different years were used to calculate the trend are Chekiang (1965, and 1970–73), Hopeh (1965, and 1970-73), Kiangsu (1965, 1969–71, and 1973), Kirin (1965-66, and 1970–72), Kansu (1965, and 1970-73), Kweichow (1965-66, and 1973), Shantung (1965, and 1970-72), Shensi (1965-66, 1970-71, and 1973), Szechwan (1965, and 1971-73), and Tibet (1965, and 1971-73).

[13] The methodology is described in app. A, below.

[14] The Spearman rank correlation coefficient is .695 (which is statistically significant at the .001 level), and the Kendall rank correlation coefficient is .532 (which is also statistically significant at the .001 level). For the formulas, see Sidney Siegel, *Nonparametric Statistics for the Behavioral Sciences*, New York, 1956, pp. 202–223.



Provincial Political-Economic Typology

FIGURE 1

A. Politically Unstable Provinces With Declines or Slow Growth

The provinces in quadrant III can be classified into two general categories: (a) those governed by politically moderate First (or ranking) Party Secretaries (Chekiang, Kweichow, Szechwan, and Yunnan); and (b) those led by political radicals (Anhwei, Kansu, Kirin, and Shanghai). Of the provinces in the latter category, Shanghai is regarded by both Chinese and Western analysts as having been the base of radical power in China. According to the present Third Secretary, P'eng Ch'ung, the radicals (who had been in power in Shanghai since the Cultural Revolution) made a mess of industrial production during the 1970's. P'eng recently claimed that Shanghai's GVIO declined from an impressive 14.8 percent growth rate in 1970 to a mere 2 percent rate in 1976 because of the radicals' factionalism and inept management.[15]

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[15] FBIS, Dec. 8, 1977, E-7. According to a recent traveler who was briefed by officials in Peking, Shanghai's GVIO grew only 1.2 percent in 1976.

Another radical-led province, Kirin, encountered similar problems. GVIO actually declined during the 1974 campaign to criticize Lin Piao and Confucius and slowed significantly during the 1976 campaign to criticize Teng Hsiao-p'ing. The present First Party Secretary, Wang En-mao, who replaced PLA commissar Wang Huai-hsiang in March 1977, acknowledged Kirin's slow development in 1976 and went on to say that it had also been slow in 1977 because of the continued "interference and sabotage"—codewords for fractional disorders—of followers of the "gang of four."[16] Although details are not available, other reports suggest that the worker unrest mentioned by Wang En-mao was most serious in the troubled Ch'ang-ch'ün Railway Subbureau[17] and may have occurred in isolated factories in other areas.

In contrast to Kirin, the two remaining radical-led provinces in quadrant III Anhwei[17a] and Kansu, were less damaged industrially by political conflict. Although Anhwei experienced some serious problems in the strategically important Huainan coal mine in 1974, it registered solid overall industrial growth in 1976—a fact highly publicized by the Anhwei radical leadership at the time.[18] No reports or indications of serious industrial unrest could be detected in the Anhwei media until the late winter and early spring 1977 when a provincial radio broadcast alluded to serious problems along the province's railways and to difficulties in meeting first quarter production targets.[19]

The sudden appearance of these problems in early 1977 coincides with the Hua administration's insistence that the intensity of the campaign to criticize the "gang of four" be stepped up in those provinces—such as Anhwei—that had been guilty of foot-dragging. In fact, Sung P'ei-chang (who was Anhwei's First Secretary at the time) was criticized after his purge in June 1977 for trying to "put a lid" on the progress of the campaign. This strongly suggests that Sung attempted to stave off pressure from Peking by sacrificing some local radicals, This move caused morale problems and considerable confusion, which in turn may explain the decline in GVIO during the first quarter. In any event. the unrest of the winter-spring period was followed by a period of growth, which lasted until Sung's purge in June and his replacement by Wan Li, the former Minister of Railways and a close associate of Teng Hsiao-p'ing.[20] After Wan's transfer to Anhwei, provincial GVIO fell off sharply for several months, indicating that Wan—a noted disciplinarian—probably ordered local leadership changes, which in turn led to disruptive activities at the lower levels. As of late December 1977, production still had not returned to the level of June.

Most of the industrial disruptions in Kansu reportedly occurred along the province's rail system, which is under the jurisdiction of the Lanchow Railway Bureau. Reports released after the purge of First Party Secretary Hsien Heng-han, who was accused among other things of "covering up" the turmoil within the Lanchow Bureau,[21] revealed that the Bureau was practically paralyzed in 1975 and 1976 and that central work teams had been sent there several times in an attempt to rectify the troubled situation.[22] The absence of reports in the provincial media concerning factory unrest suggest that these Lanchow Railway Bureau disorders were the primary source of the virtual stagnation of Kansu's GVIO in 1976.

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[16] FBIS, Jan. 10, 1978, L-1—L-15.

[17] FBIS, Jan. 10, 1978, L-9—L-11; and FBIS, Aug. 24, 1977, L-1—L-2.

[17a] For a detailed analysis of politics in Anhwei Province during the mid-1970's, see William B. Abnett, "Anhwei Province, 1949-78," in Edwin A. Winckler. ed., *Provincial Handbook of China*, Standard, forthcoming.

[18] FBIS, Jan. 4, 1977, G-3.

[19] FBIS, Apr. 12, 1977, G-1—G-2.

[20] FBIS, July 29, 1977, G-3—G-4; and FBIS, Jan. 24, 1978, G-1—G-5.

[21] FBIS, July 12, 1977, M-1—M-3.

The four other provinces in quadrant III which were led by moderate First Party Secretaries, represent four of the most seriously factionalized and politically unstable provinces in China. These provinces share the dubious distinction of having been cited officially by Peking as members of a group of seven provinces whose industrial output was most seriously damaged by the "gang of four." [23] Chekiang Province, for instance, was the subject of central directives several times during the mid-1970's. The "Chekiang problem" became so serious that PLA troops were ordered to solve it in 1975. Details in recent radio broadcasts—including approximate dates—reveal that factory unrest and factional disputes in Chekiang during 1974–76 correspond closely with the erratic changes in GVIO over the same period.[24]

Another greatly factionalized province was Kweichow, whose industrial production was so disrupted that GVIO fell by 13 percent in 1974 and, following an increase of 44 percent in 1975, dropped 12 percent in 1976. The monthly GVIO peak reached during the relatively stable year of 1975 was not regained until April 1977, after several months of floundering that followed the purge of the "gang of four." Ma Li's transfer from Hopeh to become Kweichow's First Party Secretary in March undoubtedly had a great deal to do with the sudden upsurge of Kweichow's GVIO shortly thereafter, as incompetent radicals were probably ousted from positions of responsibility. But this new growth was shortlived and the new provincial leadership failed to stabilize industrial production.

At the time of his transfer to Kweichow, Ma Li convened a four-level (provincial, prefectural, county, and district) [*hsiang*] cadre conference which emphasized production and suggested that Kweichow's new leadership would at last be able to overcome past problems and make decisive recoveries. In July 1977, however, a second four-level cadre conference was convened, during which problems such as "sabotage," theft, and the like were discussed.[25] These problems, which were encountered during the months of April to July, are reflected in Kweichow's erratic GVIO pattern during the same period. Apparently, the problems discussed at the second conference persisted until October, when the province's industrial production began to grow steadily.

Kweichow's neighbor, Yunnan, was more seriously disrupted in 1976 than in 1974 and did not begin to recover from the turmoil until the summer of 1977—several months after the replacement of First Party Secretary Chia Ch'i-yün by the politically moderate former leader of Kwangsi, An P'ing-sheng. Chia Ch'i-yün was probably replaced because of his inability to control the rival factional groups that had been actively fomenting unrest since the days of the cultural revolution, not because he was a radical.[26]

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[22] FBIS, July 11, 1977, M–1—M–4.

[23] FBIS, Jan. 3, 1977, E–18. The other three provinces were Fukien, Honan, and Kiangsi, none of which are analyzed in this section.

[24] FBIS, Nov. 29, 1976, G–6—G–8; *Issues and Studies*, vol. XIII, No. 6, 1976, pp. 602–605.

[25] FBIS, Mar. 8, 1977, J–1—J–5; and FBIS, July 31, 1977, J–1—J–8.

Finally GVIO in Szechwan—a province that was not quite so seriously disrupted as Chekiang, Kweichow and Yunnan—grew satisfactorily in 1974 but declined in 1976. Unfortunately there have been few detailed reports on Szechwan's industrial unrest during the mid-1970's. First Party Secretary Chao Tzu-yang was promoted to alternate Politburo member at the party's 11th Congress in August 1977, suggesting Peking's confidence in Chao and satisfaction with Szechwan's industrial recovery despite serious and persistent political problems. Industrial recovery, which was well underway by February 1977, has continued to the present with minor fluctuations.

B. Politically Stable Provinces With Declines or Slow Growth

The provinces in quadrant IV cannot be linked as easily as those in quadrant III. Shensi's GVIO declined in 1974, as did Hopeh's in 1976. Shensi was a hotbed of factional political activity during the 1974 campaign to criticize Lin Piao and Confucius. Provincial First Secretary Li Jui-shan was attacked in numerous wall posters [27] and a mass meeting was reportedly held in July in the provincial capital to criticize that city's second-ranking party leader. Meanwhile, in Shensi's factories, veteran workers and managers were accused of being "capitalist roaders" and then subjected to mass criticism and physical abuse. A recent radio broadcast revealed that some factories "halted production for a long time, and production fell in other units." [28] According to one report, for example, the Sian condenser plant, which had fulfilled its production quotas every year since the plant was set up, failed to do so in 1974 because of the turmoil generated by the campaign to criticize Lin Piao and Confucius.[29]

Unlike Shensi's decline (which was largely due to political conflict), Hopeh's was brought about by a combination of factionalism and natural disasters. The well-publicized "Pao-ting Incident," which occurred in the summer of 1976, resulted in considerable disruption and violence and probably had to be brought to a halt by the PLA. Although the few details of the Pao-ting incident that are available are contradictory, the incident nevertheless contributed to Hopeh's 1976 GVIO decline. Most of the decline, however, should be attributed to the devastating earthquake that leveled T'ang-shan in July.[30]

The normally stable province of Hunan—the birthplace of Mao Tse-tung—experienced periods of political turmoil during both 1974 and 1976. Factional problems existed in some localities and especially within the trade union organizations, which were heavily influenced by radicals such as T'ang Chung-fu; T'ang, a "model worker" and former Central Committee member and provincial trade union council chairman had been promoted rapidly under radical sponsorship during the Cultural Revolution, and was quickly purged following the ouster of the "gang of four."[31] T'ang appears to be representative of the young workers, who were either recruited by the "gang of four" or joined the radical cause on their own, and succeeded in attaining political power at the provincial level. T'ang and others like him, were typically Central Committee alternate members, standing committee members of the provincial CCP committee, and provincial trade union council officials. Although they were not powerful within the provincial CCP leadership (especially in moderate-led provinces such as Hunan), they wielded considerable influence and control over the trade union organizations, in which radical workers were heavily represented. T'ang Chung-fu was an active leader of the radical faction and organized worker slowdowns, criticism rallies, and other disruptive activities directed against the moderate faction. In general, trade union organizations during the mid-1970's were not only considerable more radical than their provincial CCP committee superiors, but also a real source of political unrest

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[26] For a somewhat exaggerated but nevertheless useful description of unrest in Yunnan during 1976, see *Issues and Studies*, vol. XIII, No. 12, 1977, pp. 41–52.

[27] FBIS, June 28, 1974, E–2; and FBIS, July 10, 1974, E–1.

[28] FBIS, May 31, 1977, M–2.

[29] FBIS, Jan. 31, 1978, M–3.

[30] For reports of political unrest in Shensi in 1974 see FBIS, June 28, 1974, E–2; and FBIS, July 10, 1974, E–1. For accounts of the "Pao-ting Incident," see FBIS, May 23, 1977, H–1—H–3; and New York Times, Dec. 30, 1976. On the devastation of the T'ang-shan earthquake, see New York Times, June 2, 1977, and FBIS, Jan. 7, 1977, E–1.

Hunan's provincial trade union council was rectified shortly after the purge of the "gang of four"; however, a new chairman has not yet been appointed to the council. Moreover, reports of slack management suggest that problems with local trade unions still persist.[31a] Provincial GVIO which made little progress toward recovery after the purge of the "gang" until the summer of 1977, declined again in November.

C. Politically Stable Provinces With Moderate or Strong Growth

The provinces in quadrant I generally achieved solid GVIO growth rates and were seemingly quite resistant to the chaos and unrest that affected the provinces around them. While the provinces in quadrant III possessed perhaps the least favorable political conditions for industrial growth in China, the provinces in quadrant I appear to have had the political environment and leadership most conducive to sustained, high rates of growth in industrial output. For example, Shantung Province, led by Pai Ju-ping, a man with considerable experience in economic affairs,[32] was the most successful province in China during the mid-1970's in obtaining and sustaining the optimum combination of political stability and outstanding industrial growth. There are few reports of unrest in Shantung during the 1970's and even the reports that have surfaced suggest the disorders were compparatively low-key.[33] One additional reason may have been Peking's concern with the strategically important Sheng-li oilfield. Peking undoubtedly kept a watchful eye on the province and would have reacted quickly to political turbulence. In any event, Shantung benefited greatly from the relative absence of turmoil.

The other provinces in this quadrant also experienced satisfactory GVIO growth rates amidst stable political conditions. There are, to be sure, reports of isolated factory unrest, political factionalism, and railway disturbances, but none approaches the seriousness of the turmoil experienced by the provinces in quadrants III and IV.[34] Kwangtung and Kwangsi were as much the bastions of moderate politics in China as Shanghai and Anhwei were of radicalism. The fact that Peking is the center of China's party and national government probably prevented the outbreak of serious industrial disruptions there

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[31] T'ang last appeared in public on Oct. 1, 1976, failed to be reelected to the CCP Central Committee in August 1977. He was finally criticized in a Hunan broadcast on Oct. 22, 1977. See FBIS, Oct. 28, 1977, H-1—H-3.

[31a] FBIS, Aug. 17, 1977, H-2; FBIS, Oct. 14, 1977, H-6; and FBIS, Dec. 8, 1977, H-2.

[32] Donald W. Klien, and Anne B. Clark, *Biographic Dictionary of Chinese Communism, 1921–65*, Cambridge, Mass., 1971, pp. 707–708.

[33] FBIS, Dec. 8, 1976, G-16; FBIS, May 11, 1977, E-12—E-15; and *Issues and Studies*, vol. XI, No. 1, 1975, p. 102.

Kiangsu is yet another example of a moderate power base. When Shanghai was taken over by Hua Kuo-feng's subordinates, Su Chen-hua and Ni Chih-fu, in mid-October 1976, Kiangsu's first party secretary, P'eng Ch'ung, was transferred east to run the day-to-day affairs of China's largest city. The fact that Kiangsu could spare such a man as P'eng—a man later promoted to the Politburo—at such a critical time is testimony both to the political stability of the province and to the political trustworthiness of Peng's successor, Hsü Chia-t'un.

One province in this quadrant presents an interesting contrast to the earlier examples. During the mid-1970's, Heilungkiang was led by Liu Kuang-t'ao (a radical leader who was only recently purged) yet still achieved favorable annual GVIO growth rates during the turbulent years of 1974 and 1976. Part of the explanation—as in the case of Shantung—may have been Peking's tight control of the Ta-ch'ing oilfield. In late 1976 and early 1977, however, when the Hua administration stepped up the intensity of the campaign against the "gang of four," production in Heilungkiang began to slow down. The drop in monthly GVIO at that time suggests strongly that the interference in the affairs of Heilungkiang by the moderate leadership in Peking had roughly the same disruptive effect on radical-led Heilungkiang as the radical-inspired interference during 1974 and 1976 had on moderate-led Provinces such as Hunan and Shensi.

D. A Politically Unstable Province With Strong Growth

Tsinghai, a sparsely populated province in Northwest China, is the only politically unstable province to have shown strong annual growth during the years 1974–77. Although there is not a great deal of information on worker unrest in Tsinghai during the mid-1970's, a number of reports provide revealing insights into the factional conflict and other political problems in the province. For example, shortly after Mao's death in September 1976, a Tsinghai CCP plenum was held at which it was announced that a "tiny group of class enemies that spread rumors to create confusion, disrupted public order, instigated a stoppage of work and production, and engaged in other sabotage" was currently active throughout the Province.[35] No new revelations were made, however, until the ranking CCP secretary Chang Chiang-lin was purged in March 1977 as a follower of the now-discredited "gang of four." Chang was accused of disrupting Tsinghai's highways—a serious charge since highways are Tsinghai's main mode of transport—and by implication, of disrupting Tsinghai's economy as well.[36] In addition, Chang was accused of stirring up minority problems and personally being the "root cause of the protracted unrest in Tsinghai." [37]

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[34] FBIS, Nov. 3, 1976, H-7—H-8; and FBIS, Jan. 21, 1977, H-4—H-7.

[35] FBIS, Sept. 27, 1976, M-2.

[36] FBIS, May 25, 1977, M-6.

Despite these political disruptions, Tsinghai managed to achieve strong industrial growth during the mid-1970's. GVIO grew steadily in 1974 and 1975, and increased over 22 percent in 1976—a year of chaos and poor performance in other provinces. In 1977, while the rest of China was enjoying a year of recovery in the wake of the purge of the "gang of four," Tsinghai's GVIO grew more slowly than in 1976. In fact, of the 19 provinces for which data are available for the years 1976 and 1977, only Tsinghai and Peking performed better industrially in 1976 than in 1977. Moreover, because industrial growth in Peking was slowed down by the aftereffects of the T'angshan earthquake, Tsinghai appears to be the only Province in China marching out of step in 1976 and 1977.

How did Tsinghai manage to achieve such an impressive rate of growth in 1976 with such a high level of political turbulence? Chang Chiang-lin is reported to have said, "Tsinghai is special . . .. [It] has abundant industrial and mining resources: our task is to develop industry." [38] Moreover, during the campaign to criticize local followers of the "gang of four," Chang was accused of having defied Chairman Mao by deliberately reversing economic priorities; that is, by favoring heavy industry over light industry and agriculture. The answer, therefore, may be that Chang increased industrial investment in Tsinghai in defiance of Peking's orders.

With the purge of Chang and the appointment of moderate T'an Ch'i-lung to govern Tsinghai, the provincial investment priorities were probably returned to "normal." The impact of changing priorities and of new management may have caused GVIO to grow more slowly in 1977.

IV. THE IMPACT OF POLITICAL INSTABILITY ON INDUSTRY DURING THE CULTURAL REVOLUTION AND THE MID-1970'S

The findings of the previous section show that politically stable provinces tended to achieve moderate or strong industrial growth during the mid-1970's, and that politically unstable provinces—with only one exception—failed to do so. Because the Cultural Revolution (1966–69) was also a period of political instability during which industrial output declined sharply (see fig. 2), the two periods are compared in this section.

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[37] FBIS, Dec. 6, 1977, M-2—M-3.
[38] FBIS, Dec. 6, 1977, M-2—M-3.

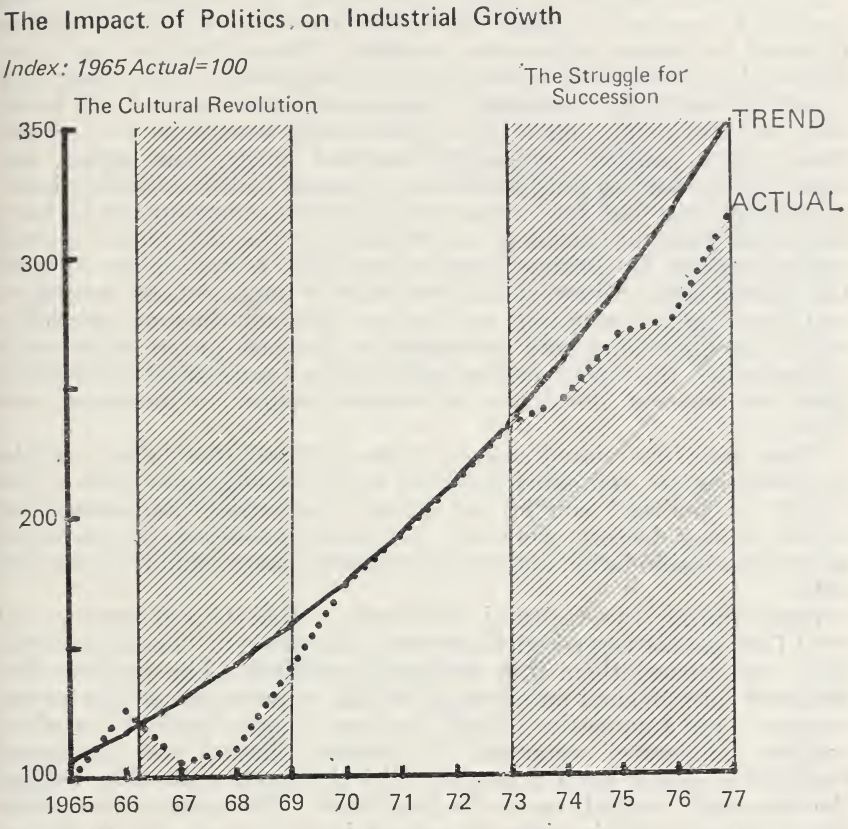

FIGURE 2

Mao Tse-tung launched the Cultural Revolution because of his dissatisfaction with what he felt was the growing ossification of the party and Government bureaucracies, and his belief that China's youth required a "revolutionary experience" to renew their faith in a revolution that had taken place before most of them were old enough to participate or even remember it. With the power struggle that broke out between the "radicals" (led by K'ang Sheng, Ch'en Po-ta, and Lin Piao) and the "moderates" (led by party bureaucrats Liu Shao-ch'i and Teng Hsiao-p'ing), the Cultural Revolution quickly became one of modern China's most chaotic periods. The Chinese Communist Party virtually disappeared as an institution, and the turmoil grew so great that PLA main-force units were ordered to restore order in many provinces and to assume control of a dozen.[39] The economic consequences of the Cultural Revolution were especially serious in the industrial sector, where factional struggles in the factories and disruptions along the transportation routes caused production to decline precipitiously and to remain below trend for 3 years.

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[39] Harvey Nelsen, "Military Forces in the Cultural Revolution," *The China Quarterly*, No. 51, July-September 1972, pp. 444–474; William W. Whitson with Huang Chen-hsia, *The Chinese High Command*, New York, 1973, pp. 390–415; and Huang Chen-hsia, *Chung-kung chün-jen chih* (Mao's Generals), Hong Kong, 1968.

In contrast to the Cultural Revolution, the midseventies were marked by sporadic, usually isolated, outbreaks of political conflict followed by periods of relative stability. The turbulence was more the result of calculated moves in local struggles for power than of a broad ideologically motivated movement that got out of hand. Central, provincial, and local leaders closely controlled each of the three major political campaigns launched during this period, and none was allowed to mushroom into a second Cultural Revolution—a development that few within the Chinese leadership would have welcomed. Only in Chekiang and Fukien did the disruptions become serious enough for Peking to order the PLA to take over. Despite this careful control, however, the cumulative impact of the campaigns on China's industrial output was serious. Although the more politically stable provinces managed to sustain or increase output during the midseventies, the provinces that suffered the most disruptive factional strife experienced slowdowns or actual declines in industrial production.

Three industry-related aspects of the Cultural Revolution and the midseventies are compared below in order to shed more light on the impact of political conflict on China's industrial production: (a) unrest among factory workers; (b) disruption along the railways; and (c) the intimidation and purge of leaders, cadres, and the economic elite.

First, during the Cultural Revolution, Red Guard groups and rival factions converged on factories in the name of "making revolution" and turned them into political battlefields. The factions that began to form opened an alternative path of advancement for young workers and frequently pitted younger, more "radical" workers against "moderate" veterans. The groups clashed and exchanged positions of power each time the political climate shifted in Peking, the provincial capital, or at the local level. The ensuing disruptions (which often ended in violence) caused factory production to decline drastically and in some cases to stop altogether until order could be restored by the intervening PLA units.

Reports of worker strikes and factory closures during the midseventies generally came from provinces with the greatest residual factionalism left over from the Cultural Revolution. The workers, who were motivated largely by self-interest, put into practice the lessons learned from the experiences of the Cultural Revolution. They participated in well-established factional networks (which had their roots in the factory and connections in Peking) to serve their own ends. As a result, the impact of factory worker disruptions was less damaging to industrial production than it had been during the Cultural Revolution, yet the workers probably achieved more tangible, longer lasting rewards.

Second, China's railways were frequently disrupted in both periods. During the Cultural Revolution, hordes of youthful Red Guards clogged the system, causing tremendous delays in transportation and shortages of raw materials.[40] The havoc was caused more by the sheer number of rebellious passengers and their "exchanging revolutionary experiences" than by the railway workers themselves.

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[40] Robert Michael Field, "Chinese Industrial Development: 1949–70", Congress of the United States, Joint Economic Committee, *People's Republic of China: An Economic Assessment*, Washington, D.C., 1972, pp. 65–66; and Parris H. Chang, "Provincial Party Leaders' Strategies for Survival During the Cultural Revolution," in Robert A. Scalapino, ed., *Elites in the People's Republic of China*, Seattle, 1972, p. 524.

During the midseventies, however, the railway workers appear to have been fully aware of their importance to the national economy and to have taken advantage of their strategic position in a deliberate attempt to better their lot. Despite the scale of the conflicts over wage policy and the lack of promotions in such important rail centers as Chengchou and Lanchou, many railway hubs, such as Peking and Canton, were relatively stable and reportedly fulfilled their production goals routinely.[41] In sum, the railway unrest of the midseventies differed from that of the Cultural Revolution because the railway workers played a more active role and fewer rail centers were affected.

Finally, the intimidation and purge of leaders, cadres, and the economic elite was markedly different in the two periods. During the Cultural Revolution, countless cadres and economic leaders were humiliated or forced into early retirement,[42] and the Chinese Communist Party was practically defunct. In contrast, the purges of the midseventies were much less severe and no party or government institutions were in jeopardy—even during the most chaotic political campaigns. During the recent campaign to criticize the "gang of four," for example, the new regime has tried to avoid the pitfalls of the Cultural Revolution purges. Although some of the purges undoubtedly have been personal vendettas inspired by enmities that can be traced to the Cultural Revolution, the Hua regime for the most part has adopted a decidedly lenient approach toward provincial and local leaders with ties to the now-discredited radical "gang of four." The recent official appearance in Peking of Politburo alternate member Saifudin, who had been stripped of his party and government posts in Sinkiang shortly before, appears to be a case in point.[43] The sudden reappearance of a purged victim after so short a period of time is highly significant, especially when it is remembered that a leader purged during the Maoist era did not usually reappear for several years—if at all.

To summarize, the basic differences between the Cultural Revolution and the midseventies are in the scope and intensity of the impact on industrial production. To illustrate the difference in the scope of the impact, table 4 shows the number of provinces in which GVIO was 5 percent or more below the trend as a percent of the number of provinces for which GVIO data are available. It can be seen that the Cultural Revolution caused industrial production to decline in 1967 and remain below trend in 1968–69 in practically every province. In contrast, only half of the provinces were 5 percent or more below trend in 1974–75 and slightly over two-thirds of the provinces in 1976, which was the height of the unrest during the midseventies. Thus the scope of the disruptions caused by the Cultural Revolution was wider than that of those caused by the struggle for succession.

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[41] JMJP, Oct. 11, 1977, FBIS, Feb. 18, 1977, E1–E6; FBIS, June 13, 1977, H6–H8; and FBIS, Dec. 20, 1977, E9.

[42] Richard K. Diao, "The impact of the Cultural Revolution on China's Economic Elite," *The China Quarterly*, No. 42, April–June, 1970, pp. 65–87.

[43] FBIS, Jan. 30, 1978, M–5; FBIS, Feb. 13, 1978, E–18—E–19; and FBIS, Feb. 8, 1978, E–1.

TABLE 4.—PROVINCES FAILING TO ATTAIN POTENTIAL INDUSTRIAL GROWTH, 1967–69 AND 1974–76

	Number of provinces for which GVIO was—		
	5 percent or more below trend	Available	5 percent or more below trend
Cultural revolution:			
1967	2	2	100
1968	12	13	92
1969	14	16	88
Struggle for succession:			
1974	10	21	48
1975	10	21	48
1976	14	20	70

The intensity of the disruptions, and consequent loss of industrial output, was severe in both periods. In his "Report on the Work of the Government," delivered to the Fifth National People's Congress in February 1978, Chairman Hua Kuo-feng said: [44]

> As a result of the interference and sabotage [of the "gang of four"] between 1974 and 1976, the nation lost about 100 billion yuan in the total value of industrial output . . . and the whole economy was on the brink of collapse.

The estimated losses for these 3 years (and for the Cultural Revolution) are shown in table 5. Hua presumably was comparing actual with planned output, but the difference between the trend (which was estimated from output in the relatively normal years of 1965–66 and 1970–73) and actual output gives a reasonable estimate of the loss in the years 1974–76.

TABLE 5.—INDUSTRIAL OUTPUT LOST DURING THE CULTURAL REVOLUTION AND THE STRUGGLE FOR SUCCESSION, 1967–69 AND 1974–76

	Billion 1957 yuan			Loss as a percent of potential
	Potential output	Actual output	Loss	
Cultural revolution:				
1967	180.5	147.2	33.3	18.4
1968	199.3	154.7	44.6	22.4
1969	220.0	197.3	22.7	10.3
Total	599.8	499.2	100.6	16.8
Struggle for succession:				
1974	361.0	340.6	20.4	5.7
1975	398.5	374.3	24.2	6.1
1976	440.0	382.7	57.3	13.0
Total	1,199.5	1,097.6	101.9	8.5

Sources: Potential output: Estimated by regressing the logarithm of output in 1965–66 and 1970–73 against time. Actual output: CIA, "The Gross Value of Industrial Output in the People's Republic of China: 1965–1977," forthcoming.

When the loss of industrial output in the mid-1970's is compared with the loss in the Cultural Revolution, it can be seen that the disruption was not as serious as in the earlier period. In the turbulent year 1974, GVIO actually declined in only four of the provinces examined in this section, and in the year 1975 (when Teng Hsiao-p'ing's moderate economic policies were in force), the situation was relatively stable, and industry began to recover. Only after the purge of Teng Hsiao-p'ing in 1976 and the launching of the divisive campaign to discredit him did the intensity of the political conflict have an impact on industrial output approaching that of the Cultural Revolution. It is clear that the Cultural Revolution, which disrupted China with an intensity approaching madness, was more damaging than the struggle for succession of the mid-1970's.

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[44] *Peking Review*, No. 10, 1978, p. 12.

V. THE EMERGING SHAPE OF INDUSTRIAL POLICY IN POST-MAO CHINA [45]

In the 18 months since the purge of the "gang of four," the new leadership has taken steps to restore order to the economy and has proceeded to jettison institutional and ideological baggage that stands in the way of improved efficiency and higher productivity. At the Fifth National People's Congress in March 1978,[46] Hua Kuo-feng underlined the importance of the modernization drive first publically articulated by Chou En-lai in his work report at the Fourth National People's Congress in January 1975.[47] In addition, Hua emphasized aspects of the drive that had been spelled out in a 1975 State Council draft entitled "Some Problems in Accelerating Industrial Development" [48]. Chou had stressed the importance of the Fifth 5-Year Plan (1976–80) in completing the first stage of a strategy to modernize the economy by the end of the century. After the inauspicious start on the Fifth 5-Year Plan, however, Hua incorporated it in a 10-year plan that is to run through 1985.

Three recently announced targets for 1985 are presented in table 6. The projected increases of 10 percent per year for the gross value of industrial output and 7.2 percent for coal seem achievable when compared with the record of the last 12 years. Nevertheless, a doubling of industrial production over the next eight years will require accelerated energy production (which will put severe pressure on the petroleum industry) and a large-scale industrial construction program (including stepped up imports of high-technology plant and equipment from Japan and the West).

TABLE 6.—ACTUAL AND PLANNED OUTPUT OF CHINESE INDUSTRY SELECTED YEARS, 1965–85

	Gross value of industrial output (billion 1957 yuan)	Coal (million tons)	Crude steel (million tons)
Output:			
1965	139.3	240.0	12.5
1970	242.2	338.0	17.8
1975	374.3	480.0	25.0
1976	382.7	471.0	22.0
1977	436.3	519.0	25.0
1985 target	935.0	904.0	60.0
Rate of growth:			
1966–70	11.7	7.1	7.5
1971–75	9.1	7.3	7.0
1976–77	8.0	4.0	0
1978–85	10.0	7.2	11.6

Sources:

1965–77: Gross value of industrial output: CIA "The Gross Value of Industrial Output in the People's Republic of China: 1965–1977," June 1978. Coal and crude steel: Preliminary revision of previous CIA estimates.

1985 targets: Gross value of industrial output and crude steel: Hua Kuo-feng, "Report on the Work of the Government," Peking Review, No. 10, 1978, p. 19. Coal: Derived from the statement that output is to double between 1977 and 1987. See Hsiao Han, "Developing Coal Industry at High Speed," Peking Review, No. 8, 1978, p. 6.

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[45] We are greatly indebted to Bobby A. Williams and Joe W. Hart both of whom gave us invaluable assistance in preparing this section.

[46] Hua Kuo-feng, "Report on the Work of the Government," *Peking Review*, No. 10, 1978, pp. 18–19.

[47] Chou En-lai, "Report on the Work of the Government," *Peking Review*, No. 40, 1975, p. 23.

[48] Draft dated Sept. 2, 1975; translated in *Issued and Studies*, vol. XIII, No. 7, 1977. The draft is commonly referred to as the "Twenty Points."

The announced goal of producing 60 millon tons of steel by 1985 (compared with 25 million tons in 1977 and a capacity of about 35 million tons[48a]), however, appears unrealistic, implying as it does a 25-million ton increase in capacity within 8 years. Current plans call for expanding the capacity of the Anshan steel plant from 7 million tons to about 12 million tons and for building a new 6 million ton steel combine in Shanghai. It is unlikely that both of these projects, which are to be purchased from Japan, can be completed by 1985. In any event, their completion would add less than half of the additional capacity needed. Chinese efforts to renovate other plants, together with a more effective use of raw materials inputs, could conceivably provide 10 million tons of steel output annually. Under the best of circumstances, annual production is unlikely to exceed 50 million tons by 1985.

Peking recognizes its goals are extremely ambitious but evidently believes that many factories and mines habitually operate well below levels obtainable in more industrialized nations and that greater efficiency by management and labor can yield substantial gains in both the quantity and quality of output. Reforms are already apparent in industrial onganization, factory management, wages and incentives, and the treatment of managerial and technical personnel. At the same time, major revisions are being made in investment priorities to favor persistent trouble spots such as coal and metals mining, steel finishing facilities, electric power, and the transport sector.

A. Industrial Organization

> . . . Some localities and units have ignored the overall interests and the unified regulations of the central authorities by willfully formulating policies in violation of state plans, wantonly changing the direction of production of the decentralized enterprises, discontinuing the relationships of coordination and cooperation previously established, having failed to complete the missions of transferring products to higher levels, arbitrarily adding basic construction projects and enlarging the size of construction, and wantonly securing and expending materials and funds. Wilfully increasing the number of staff and workers, as well as the total amount of wages, and changing commodity prices without authorization are not permissible.[49]

Several developments indicate that the Government is returning to organizational structures in industry that either were eliminated or severely undermined during the Cultural Revolution. The objective seems to be both greater centralization—at least in the short run—and increased efficiency.

One recent manifestation of increased centralization was the revamping of the State council announced at the Fifth National People's Congress in March 1978.[50] For example, the Ministry of Petroleum and Chemical Industries was split into separate ministries for petroleum and chemicals.[51]

Of particular interest has been the reestablishment in 1977 of the National Petroleum Corp., which reportedly has taken over operational responsibility for the oil industry, leaving the Ministry of

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[48a] Hua Kuo-feng told the Fifth National People's Congress that 28 million tons of steel had been lost during the years 1974-76 (Peking Review, No. 10, 1978, p. 12). If loss is defined as the difference between capacity and actual output, then average capacity (in million tons) should be one-third of the sum of actual output and the reported loss, or $\frac{1}{3}(24+25+22+28)=33$. As additions to capacity during the period were small, current capacity is probably no more than 35 million tons.

[49] "Twenty Points," p. 101.

[50] FBIS, supplement 1, Mar, 16, 1978, p. 73. For discussions of the need to strengthen central control, see "Twenty Points," pp. 99-102; and Hua Kuo-feng's remarks in his speech to the Fifth National People's Congress, in "Peking Review," No. 10, 1978, p. 25.

[51] FBIS, Mar. 6, 1978, D-13—14.

Petroleum Industry charged mainly with policy formulation. A similar ministerial-corporate structure also may be the next step in the thoroughgoing reorganization of the agricultural machinery industry that has been called for by State Planning Commission Chief Yü Ch'iu-li. Corporations had been set up in these and several other industries in 1964–65 but were later abolished after condemnation by radicals as capitalist "monopoly trusts." [52]

Although details are sketchy, the corporate idea seems to have two rationales. As described in 1964–65, the corporations, and the enterprises under their control, were to be relatively free from interference by local political authorities; especially in matters of policy, they were to be accountable only to the central authorities in Peking. In addition, such enterprises would be "specialized" rather than "self-sufficient" (that is., integrated), thereby reducing redundancy in organization, personnel, and fixed assets.[52a]

Another sign that pre-Cultural Revolution organizations are being reestablished is the reappearance of the 6 great regions into which China's 29 provinces had been grouped for planning purposes. While little has been disclosed about how this regional framework operated in the past, oblique references by Yü Ch'iu-li and Hua Kuo-feng to a "regional economic system in each of the six major regions" suggests that they have been revived to facilitate long-term planning and to centralize responsibility.[53]

B. Enterprise Management

> . . . There are also some enterprises whose ideological and political work have been fainthearted and flabby, management chaotic, labor productivity low, quality of products inferior, losses great, costs high, and accidents numerous, inflicting serious losses on the state and the people. These enterprises must have their enterprise management rectified and their rules and systems tightened up.[54]

In an attempt to hasten the restoration of economic stability, the new government has called for the abolition of factory revolutionary committees—enterprise management bodies formed during the Cultural Revolution.[55] These bodies—normally composed of representatives of old party cadres, young revolutionaries, and the PLA—have been a source of disruption in industrial management and planning over the past decade. Day-to-day control of operations is being returned to seasoned managers, each with sole responsibility for his component. Along with this elimination of management by committee is a concerted effort to restore those systems (such as financial and quality control, and adherence to materials consumption norms) needed for effective management.[56] These measures, along with improved labor discipline, are intended to be the major sources of production gains during 1978–80.[57]

Of perhaps more far-reaching consequence are reports that Peking is studying managerial techniques in Yugoslavia and advanced industrial nations.[58] The particular aspects of Yugoslavia's unique socialist system that most interest the Chinese are not yet clear; in any event, Belgrade has experienced many of the problems that Peking must face in order to balance centralizing and decentralizing forces. In Japan, visiting Chinese delegations are asking questions that span the entire spectrum of industrial practice—for example: How much iron ore under optimal conditions is required per unit of steel output? How are the skills of craftsmen nurtured? What scheme of wages and premiums best motivates workers?

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[52] *Current Scene* vol. VI, No. 17, 1968, ibid., No. 22, 1968.

[52a] At the national farm mechanization conference in early 1977, Yü Ch'iu-li unveiled plans to reorganize the farm machinery industry, with "general large-scale" plants and "general small-scale" plants to be replaced by "large-scale specialized" production facilities. One of the experiences cited at the conference was how local authorities in Ch'ang-chou, by combining individual gearmaking equipment from seven tractor plants into one large plant and adopting more up-to-date techniques, were able to double the rate of production in 6 months. See FBIS, Jan. 31, 1978, E-14—E-16.

[53] FBIS, May 9, 1977, E-19; and *Peking Review*, No. 10, 1978, p. 19.

[54] "Twenty Points," pp. 96–97.

[56] See Hua Kuo-feng's speech in *Peking Review*, No. 10, 1978, pp. 31–32.

[56] See the State Council circular reported in FBIS, Dec. 13, 1977, E-1, and for further details, the remarks of Yü Ch'iu-li in FBIS, May 9, 1977, E-21ff.

[57] See Hua's speech in *Peking Review*, No. 10, 1978, p. 22.

C. Wages and Incentives

> . . . Egalitarianism will not work now, nor will it work in the future. "From each according to his ability, to each according to his work; he who does not work, neither shall he eat" is a socialist principle. At the present stage, it is basically compatible with the requirements of productivity development, and thus must be resolutely carried out. Equal distribution without regard to intensity of labor performed and to different degrees of ability and contribution will be detrimental to mobilization of the socialist initiative of the broad masses.[59]

Peking's success in bolstering economic growth during the remainder of the Fifth 5-Year Plan period will depend heavily on its ability to improve work incentives and boost labor productivity. When the present government took office in October 1976, it faced a disgruntled work force, which since 1974 had increasingly resorted to slowdowns, absenteeism, and strikes to protest eroding living standards and the inability of government to reach agreement on wage increases. One year later, with low morale and low productivity still serious problems, the new leadership announced pay increases for three-fifths of the urban labor force.[60] Peking carefully emphasized that the wage increase was made possible by the improving economic situation, but everyone realized that the move was intended to buy time until a consensus could be built on more comprehensive measures to raise living standards.

The pay hike probably has mollified workers to some extent and reduced absenteeism, but troublesome labor problems continue.[61] The wage increase—amounting to 10 to 15 percent for the lowest paid workers and 10 percent overall—is probably regarded by many as token.

Given the magnitude of worker discontent, nothing short of a thorough wage reform, with revised pay scales and provisions for regular promotions and more pay for more work, is likely to halt industrial strife. This was specifically recognized in the "Twenty Points," which repudiated excessive egalitarianism in wage policy and cited the need to (a) build more dormitories for workers; (b) improve the operation of mess halls, nurseries, and medical services; (c) improve the organization of spare-time educational, cultural, and recreational activities; and (d) solve the problem of husbands and wives working in separate places for long periods.[62]

Press commentary in recent months leaves no doubt that production bonuses and piece rates (abolished in the late 1960s amid Cultural Revolution condemnation of material incentives) will be readopted.[63]

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[58] The Washington Post, Apr. 3, 1978, p. A-14; "JMJP," Feb. 23, 1978, p. 5; and FBIS, Feb. 24, 1978, A11-A15.

[59] "Twenty Points," p. 108.

[60] *Peking Review*, No. 49, 1977, p. 3.

[61] See, for example, the report of work stoppages in Wuhan during January-February, 1977, in *The Economist*, Dec. 31, 1977, p. 15.

[62] "Twenty Points," pp. 109-10.

[63] See, for example, the series of articles in *Kuang-ming jih-pao*, Nov. 21, 1977, p. 3, reported in FBIS, Dec. 2, 1977, E13-E18.

Significantly, the favorable effect of bonuses and piece rates on labor productivity has been cited as a major argument for their revival.

Approval of a reform package that meets most of the demands of urban workers is no guarantee that labor problems will not reemerge. Until growth in agriculture accelerates and problems in consumer goods production are ironed out, gains in consumption will remain small.[64] Previous administrations also have assigned high priorities to both agriculture and light industry. Agricultural progress has been slow, however, and the commitment to expand production of consumer goods sometimes has been subordinated in a bureaucracy traditionally geared to expanding output of producer goods.

D. Science and Technology

> . . . Serious sabotage by the gang of four wrought havoc with China's science and education. Large numbers of universities, colleges, and scientific research institutes were disbanded . . . And basic scientific and theoretical research in particular has been virtually done away with. The quality of education has declined sharply . . . Various fields of work are keenly feeling the shortage of successors for scientific and technical endeavors. Science and education are lagging so far behind that they are seriously hindering the realization of the four modernizations.[65] [66]

Characterizing science and technology as the "key" to its modernization efforts, Peking began early to repair the damage done to education and research by the Cultural Revolution. Meeting the human capital requirements of a modernization program would have been difficult under the best of circumstances; now, the "crisis" [67] in education and science is perhaps the major obstacle to the fulfillment of China's ambitious goals.

For the past 1½ years, the new leadership has been deciding precisely what directions its science policy should take. Two major planning conferences were held in late 1977 and early 1978—one for natural sciences, the other for more general scientific and technical matters.[68]

These efforts culminated in the national science conference, held in March 1978. There, with much fanfare and a speech by Vice Premier Teng Hsiao-p'ing, a draft plan—"Outline Plan for the Development of Science and Technology, 1978–85"—was presented.[69] The plan is broad in scope, covering everything from very basic considerations on education to foreign training for Chinese scientists and the general areas of research to be tackled during the next 8 years. Fang I in an earlier speech, had announced that the tentative plan was to concentrate research work "on a number of key problems in industry, agriculture, and national defense." [70] In his discussion of the outline plan at the recent conference, Fang elaborated on those key problems; he focused on eight areas of research, three of which apply directly to industry: energy, materials, and computers. Touching in turn upon oil, coal, and electric power—all of which are priority concerns—Fang also brought up the need to explore new sources of energy, mentioning first the need to step up research on atomic energy. In materials research, he cited metallurgy, holding up the needs of the steel industry, in particular the beneficiation of hematite, as an item of top priority; Fang went on to bring up a number of nonferrous metals industries where research is needed to solve a number of technical problems. His discussion of research on computers simply noted the large number of areas where computers are valuable tools and declared Peking's intentions to build a "fair-sized" computer industry by 1985.

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[64] Problems in light industry have been described as "acute"; see the article by the theoretical group of the Ministry of Light Industry in JMJP, Oct. 28, 1977, p. 2, reported in FBIS, Nov. 8, 1977, E15.

[65] Vice Premier Fang I in a speech to the Chinese People's Political Consultative Conference, December 1977. See FBIS, Dec. 30, 1977, E-4.

[66] Fang I is also a Politburo member, vice president of the Academy of Sciences, and minister in charge of the State Scientific and Technological Commission.

[67] FBIS, Aug. 6, 1976, E-5.

[68] FBIS, Mar. 29, 1978, E-10.

[69] *Ibid.*

[70] FBIS, Dec. 30, 1977, E-8.

The new leadership is keenly aware of the importance of scientific-technical work to China's modernization and views most post-Cultural-Revolution reforms in education and research as impediments to progress. More traditional institutions, they believe, will better serve China's current needs. Despite added spending on science and technology, shortages of research personnel and educators will persist for some time. The recognition that this is so is reflected in the careful attention to the needs of agriculture, industry, and national defense over the next 8 years and the concentration of scientific resources on a limited number of projects with a reasonable possibility of quick payoffs.

E. Investment

> . . . The state plans to build or complete 120 large-scale projects, including 10 iron and steel complexes, 9 nonferrous metal complexes, 3 coal mines, 10 oil and gas fields, 30 power stations, 6 new trunk railways, and 5 key harbors. The completion of these projects added to the existing industrial foundation will provide China with 14 fairly strong and fairly rationally located industrial bases.[71]

In his February 1978, report to the National People's Congress, Hua Kuo-feng described the massive investment program that will be required to fulfill the new 10-year economic plan. He said that as much will have to be budgeted for capital construction during 1978–85 as was spent during the previous 28 years.[72]

Little more is known of Peking's industrial investment plans; yet priorities clearly are being centered on attaining a better balance and a substantially higher level of modernization in the industrial sector. To assist in achieving these goals, China's leaders now envisage a substantial role for imported industrial equipment and technology. The important contribution expected of foreign trade can be seen in statements by top Chinese leaders, in articles in the official press, and in the recent Sino-Japanese long-term trade agreement.

Appendix A. Provincial Political Stability Methodology

The methodology described in this appendix was used to compile the provincial political stability index that is presented in Section III, above. Although only 19 provinces were analyzed in Section III, all 29 of China's provinces are ranked here. The rank was based on four political criteria.

First, the provincial CCP leadership (all Party secretaries from first through deputy and all standing committee members) of each provincial CCP committee was rated using as measures of political stability such criteria as length of time in office; occurrence of purges, demotions, and transfers; and reports of official and unofficial criticism.

Second, each ranking Party secretary was assigned to one of six categories based on his disposition following the purge of the "gang of four." The categories (listed in ascending order of probable negative impact on provincial stability) are: (1) retention in place, (2) promotion in place; (3) transfer but no demotion; (4) transfer and promotion; (5) transfer and demotion; and (6) purge. After each ranking secretary was categorized, political reports and the provincial media were perused for statements that charged the ranking secretary retrospectively with fomenting political factionalism and disorder during the mid-1970's. If the charges were consistent with our analysis of political developments in the province concerned, then the province was given a negative score.

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[71] Hua Kuo-feng, "Report on the Work of the Government," *Peking Review*, No. 10, 1978, pp. 22–23.
[72] Ibid., p. 19.

Third, each province that had been the subject of a Central Directive—which is an authoritative, internal communication of the Party Central Committee that details Peking's concern with a particular problem or event—was given a negative score if the Central Directive dealt with a problem that affected the political stability of the province or a major portion of the province.

Fourth, each province was scored according to the relative degree of political stability at its local levels. The analysis of the localities is crucial for any index of provincial political stability during the mid-1970s not only because the local levels were the sites of unrest among factory and railroad workers but also because they were the areas where political factionalism was most likely to have had a serious impact on the industrial production. The scores were based on an analysis of the Chinese national, provincial, and local media; of the relevant sections of the forthcoming *Provincial Handbook of China*,[73] and of reporting on Chinese internal politics released by such sources as the Hong Kong press, Agence France Presse and Reuters.

After each province's scores in the four categories were tallied, the 29 provinces were then ranked in descending order of political stability. Although the ranking of the provinces reflects subjective judgments, the fact that each province has been scored systematically in four areas prevents the methodology from being arbitrary. To facilitate comparison of our ranking with the rankings for two earlier periods prepared by Frederick C. Teiwes,[74] we have also classified the 29 provinces according to his four "stability categories." The categories are: I (highly stable), II (basically stable), III (variable), and IV (unstable). Our rankings are presented in Table A–1 and compared with those of Teiwes.

TABLE A–1.—RANKING OF CHINA'S PROVINCES BY POLITICAL STABILITY

	Overall provincial political stability (1974–77)		Teiwes' stability of provincial party secretaries			
			1967–73[1]		1956–66[2]	
Province	Rank	Stability category	Rank	Stability category	Rank	Stability category
Shantung	1	I	15	III	25	IV
Kwangsi	2	I	10	II	20	III
Kiangsu	3	I	1	I	1	I
Kwangtung	4	I	13	III	12	II
Shensi	5	I	3	I	15	II
Inner Mongolia[3]	6	I	28	IV	7	I
Hunan	7	II	22	III	19	III
Tibet	8	II	16	III	6	I
Shansi[3]	9	II	27	III	5	I
Peking	10	II	25	III		
Tientsin[3]	11	II	14	III		
Hopeh	12	II	17	III	11	II
Ningsia[3]	13	II	21	III	17	III
Heilungkiang	14	II	20	III	10	I
Anhwei	15	III	8	II	23	III
Tsinghai	16	III	7	II	24	IV
Sinkiang[3]	17	III	26	III	13	II
Hupeh[3]	18	III	12	III	9	I
Kiangsi[3]	19	III	24	III	2	I
Szechwon	20	III	18	III	3	I
Kansu	21	III	9	II	26	IV
Honan[3]	22	III	2	I	22	III
Fukien[3]	23	III	19	III	8	I
Kirin[3]	24	IV	5	II	4	I
Shanghai	25	IV	6	II		
Liaoning	26	IV	4	I	16	III
Yunnan	27	IV	11	II	18	III
Kweichow	28	IV	29	IV	21	III
Chekiang	29	IV	23	III	14	II

[1] Frederick C. Teiwes, "Provincial Politics in China: Themes and Variations," in John M. H. Lindbeck, ed., China: Management of a Revolutionary Society, Seattle, 1977, p. 152.

[2] Frederick C. Teiwes, Provincial Leadership in China: The Cultural Revolution and Its Aftermath, Ithaca, N.Y. 1974, p. 131.

[3] These provinces were not analyzed in sec. III because GVIO data were not available for each of the years 1974–77

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[73] Edwin A. Winckler, ed., *Provincial Handbook of China*, Standford, forthcoming. This paper has greatly benefitted from many lengthy and rewarding discussions with the editor and many of the chapter writers.

[74] "Provincial Politics in China: Themes and Variations," in John M. H. Lindbeck, ed., *China: Management of a Revolutionary Society*, Seattle, 1971, pp. 150–153; *Provincial Leadership in China: The Cultural Revolution and its Aftermath* ,Ithaca, N.Y., 1974, pp. 130–136.

Teiwes' rankings are for personnel stability within provincial CCP secretariats in contrast to our ranking of overall political stability. Teiwes examined data covering (a) the secretaries' length of time in office; (b) the occurrences of purges, demotions and turnovers of secretaries; and (c) the sizes of "core groups" of secretaries who served together for long periods of time. Teiwes' rankings provided him with a systematic means of making qualitative judgments about provincial politics in general and quantitative judgments about the strength of the relationships between personnel stability and other political, social or economic variables.

Teiwes attributed the difference between his two rankings to changes in the Chinese political system caused by the turbulence of the Cultural Revolution. He argued that the Cultural Revolution changed the situation that had existed in the 1950s and early 1960s, in which the richer more developed provinces tended to be more stable than the poorer provinces. He concluded that "Mao had created an environment in which skill in adjusting to contradictory political signals and shifting power alignments became critical for survival." [75]

The differences between Teiwes' rankings and ours are due not only to further changes in the Chinese political system brought on by the struggle for succession in the mid-1970s but also to our more comprehensive system of rating.

APPENDIX B. MONTHLY INDUSTRIAL OUTPUT FOR SELECTED PROVINCES IN RECENT YEARS

The data on monthly industrial output presented in Tables B-1 through B-22 were derived from the large number of statements on industrial performance that were broadcast or published during 1977 and early 1978. Typical of these statements are the following two, which were used in calculating monthly industrial output in Sinkiang:

> From January to August this year, the total industrial output value of our region surpassed the previous corresponding period. It was equivalent to 68.3 percent of the target figure set for this year and showed a 17.17 percent rise over last year's corresponding period.[76]
>
> The total value of industrial production in 1977 overfulfilled the plan by 7.27 percent, an increase of 11.72 percent over 1976.[77]

In the first statement we are told that 68.3 percent of the annual plan was fulfilled during the first eight months of the year, or a monthly average of 8.5 percent of the plan. In the second statement we are told that the plan was overfulfilled by 7.27 percent. From these two percents we can calculate that 39.0 percent (that is, 107.3−68.3) of the output originally planned for the year was produced during the last four months, or a monthly average of 9.8 percent of the plan.

Similarly, output in 1976 can be related to the output planned for 1977. In the first eight months of 1976, output was 58.3 percent (that is, 68.3÷1.1717) of that planned for 1977, or a monthly average of 7.3 percent of the 1977 plan. During the entire year 1976, output was 96.0 percent (that is, 107.3÷1.1172) of that planned for 1977. Finally, output in the last four months of 1976 was 37.7 percent (that is, 96.0−58.3) of that planned for 1977, or a monthly average of 9.4 percent.

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[75] Ibid., p. 135.

[76] FBIS, Oct. 14, 1977, M9.

[77] FBIS, Feb. 7, 1978, M4.

TABLE B-1.—MONTHLY INDUSTRIAL OUTPUT IN ANHWEI, 1976–77

[Planned output in 1977=100]

	Cumulative output since Jan. 1	Output in period	
		Total	Monthly average
1976:			
January–March	19.3	19.3	6.4
July–December		48.4	8.1
1977:			
January	5.4	5.4	5.4
February	10.8	5.4	5.4
March	18.7	7.9	7.9
April	26.9	8.2	8.2
May	36.4	9.5	9.5
June	46.9	10.5	10.5
July–December	100.0	53.1	8.9
1978: January–February	14.2	14.2	7.1

Sources:

January–March 1976: Derived from cumulative output through March 1977 and the statement that output in the 1st quarter of 1977 was 3.3 percent less than in the corresponding period of 1976. See BBC, FE/W965/A/3, Feb. 1, 1978.

July–December 1976: Derived from output in the 2d half of 1977 and the statement that output in the 2d half of 1977 increased 9.8 percent over the corresponding period of 1976. See FBIS, Jan. 24, 1978, G5.

January–June 1977: Derived from output in the 2d half of 1977 and the statement that output in the 2d half of 1977 increased 13.3 percent over the 1st half (see FBIS, Jan. 24, 1978, G5). The individual months were derived from the following increases over the preceding months:

	Percentage increase	Index (January=100)	Source
January		100.0	
February	0	100.0	Assumed.
March	46.0	146.0	FBIS, May 12, 1977, G1.
April	3.5	151.1	Ibid.
May	15.6	174.7	FBIS, June 13, 1977, G5.
June	10.0	192.2	Assumed.

July–December 1977: Assumed that the plan was fulfilled

January–February 1978: Derived from the statement that output in the 1st 2 mo of 1978 increased 31.2 percent over the corresponding period of 1977. See Hopei Provincial Service, Mar. 29, 1978.

TABLE B-2.—MONTHLY INDUSTRIAL OUTPUT IN CHEKIANG, SELECTED MONTHS, 1973 AND 1976–77

[Planned output in 1977=100]

	Cumulative output since Jan. 1	Output in period	
		Total	Monthly average
1973:			
January–June	43.0	43.0	7.2
July–November	98.7	55.7	11.1
1976:			
January–August	56.0	56.0	7.0
September–November	77.8	21.8	7.3
1977:			
January	4.8	4.8	4.8
February	9.6	4.8	4.8
March	17.1	7.5	7.5
April	25.7	8.6	8.6
May	36.9	11.2	11.2
June	50.3	13.4	13.4
July–August	70.5	20.2	10.1
September–October	92.0	21.5	10.8
November	105.7	13.7	13.7
1978: January–March	29.1	29.1	9.7

Sources:

January–June 1973: Derived from cumulative output through June 1977 and the statement that output in the 1st half of 1977 increased 17 percent over the corresponding period of 1973, the previous peak. See JMJP, July 22, 1977.

July–November 1973: Derived from cumulative output through November 1977 and the statement that output in the 1st 11 mo of 1977 increased 7.1 percent over the corresponding period of the previous peak, here assumed to be 1973. See TKP (HK), Dec. 29, 1977.

January–August 1976: Derived from cumulative output through August 1977 and the statement that output in the 1st 8 mo increased 25.9 percent over the corresponding period of 1976. See FBIS, Sept. 20, 1977, G1.

September–November 1976: Derived from cumulative output through November 1977 and the statement that output increased 35.8 percent over the corresponding period of 1976. See TKP (HK), Dec. 29, 1977.

January–June 1977: Derived from the statement that 50.3 percent of the plan was fulfilled by the end of June (see JMJP, July 22, 1977). The individual months were derived from the following increases over the preceding month:

	Percentage increase	Index (January=100)	Source
January		100,0	
February	0	100,0	Assumed.
March	55	155.0	FBIS, May 3, 1977, G3.
April	15.4	178.9	FBIS, May 24, 1977, G2.
May	30.81	234.0	Chekiang provincial broadcast, July 21, 1977.
June	19.3	279.1	Chekiang provincial broadcast, July 21, 1977.

July–August 1977: Derived from the statement that 70.5 percent of the plan was fulfilled by the end of August. See FBIS, Sept. 20, 1977, G1.

September–October 1977: Derived from the statement that 92 percent of the plan was fulfilled by the end of October. See FBIS, Nov. 28, 1977, G5.

November 1977: Derived from the statement that 105.7 percent of the plan was fulfilled by the end of November. See TKP (HK), Dec. 29, 1977.

January–March 1978: Derived from the statement that output in the 1st 3 mo of 1978 increased 70.1 percent over the corresponding period of 1977. See FBIS, Apr. 19, 1978, G5.

TABLE B-3.—MONTHLY INDUSTRIAL OUTPUT IN FUKIEN, SELECTED MONTHS, 1976–78

[Planned output in 1977=100]

	Cumulative output since Jan. 1	Output in period	
		Total	Monthly average
1976:			
January–September	66.5	66.5	7.4
October	73.4	6.9	6.9
November	81.4	8.0	8.0
December	91.7	10.3	10.3
1977:			
January	8.3	8.3	8.3
February–September	78.1	69.8	8.7
October–November	98.3	20.2	10.1
December	108.8	10.5	10.5
1978: January	10.8	10.8	10.8

Sources:

January–September 1976: Derived from cumulative output through September 1977 and the statement that output in the 1st 9 mo increased 17.5 percent over the corresponding period of 1976. See FBIS, Nov. 9, 1977, G3.

October–December 1976: Cumulative output through Dec. 5 was derived from cumulative output through Dec. 5, 1977, and the statement that output increased 20.4 percent over the corresponding period of 1976 (see FBIS, Jan. 5, 1978, G11). Output in the months of October, November, and December was estimated from total output in the period October–Dec. 5 and from the monthly increases in November and December of 15.5 percent and 28 percent (see FBIS, Feb. 18, 1977, G7) on the assumption that average daily output was constant in December. The equations for calculating the estimates are:

$$\text{Oct.}+\text{Nov.}+\frac{5}{31}\text{Dec.}=16.6$$
$$\text{Nov.}=1.155\ \text{Oct.}$$
$$\text{Dec.}=1.28\ \text{Nov.}$$

January 1977: Derived from output in the month of January 1978 and the statement that output in January 1978 increased 29.1 percent over that of January 1977. See Foochow Provincial Service, Feb. 9, 1978.

February–September 1977: Derived from the statement that 78.1 percent of the plan was fulfilled by the end of September. See FBIS, Nov. 9, 1977, G3.

October–November 1977: Derived from the statement that the plan was fulfilled on Dec. 5, 1977, on the assumption that average daily output was constant in December. See FBIS, Jan. 5, 1978, G11.

December 1977: Derived from cumulative output through December 1976 and the statement that output increased 18.62 percent over that of 1976. See FBIS, Jan. 6, 1978, G3.

January 1978: Derived from the statement that output in January 1978 increased 5.3 percent over the average monthly output in the 4th quarter of 1977. See Foochow Provincial Service, Feb. 9, 1978.

TABLE B-4.—MONTHLY INDUSTRIAL OUTPUT IN HEILUNGKIANG, SELECTED MONTHS, 1976–77

Planned output in 1977=100]

	Cumulative output since Jan. 1	Output in period	
		Total	Monthlly average
1976:			
January–March	13.6	13.6	4.5
April–August	60.7	47.1	9.4
1977:			
January–March	22.0	22.0	7.3
April–June	48.4	26.4	8.8
July–August	66.3	17.9	9.0
1978: January–March	26.4	26.4	8.8

Sources:

January–March 1976: Derived from output in the 1st quarter of 1977 and the statement that output in the 1st quarter of 1977 increased 62 percent over the corresponding period of 1976. See "Learn from Taching," p. 6.

April–August 1976: Derived from cumulative output through August 1977 and the statement that output in the 1st 8 mo of 1977 increased 9.3 percent over the corresponding period of 1976. See FBIS, Oct. 5, 1977, LI.

January–March 1977: Derived from the statement that 22 percent of the plan was fulfilled by the end of March. See "Learn from Taching," p. 6.

April–June 1977: Derived from cumulative output through March 1977 and the statement that output in the 2d quarter increased 20 percent over the 1st quarter. See FBIS, Oct. 5, 1977, LI.

July–August 1977: Derived from the statement that 66.3 percent of the plan was fulfilled by the end of August. See FBIS Oct. 5, 1977, LI.

January–March 1978: Derived from the statement that output in the 1st 3 mo increased 20.2 percent over the corresponding period of 1977. See FBIS, Apr. 25, 1978, L10.

TABLE B-5.—MONTHLY INDUSTRIAL OUTPUT IN HOPEH, 1975–77

[Planned output in 1977=100]

	Cumulative output since Jan. 1	Output in period	
		Total	Monthy average
1975:			
January–June	42.0	42.0	7.0
July–December	101.3	59.3	9.9
1976:			
January–June	46.2	46.2	7.7
July–December	86.7	40.5	6.8
1977:			
January–June	49.0	49.0	8.2
July–December	100.0	51.0	8.5

Sources:

January–June 1975: Derived from cumulative output through June 1976 and the statement that output in the 1st half of 1977 increased 10 percent over the corresponding period of 1975. See BBC, FE/W890/A/6, Aug. 11, 1976.

July–December 1975: Derived from the cumulative output through December 1977 and the statements that output in 1975 was 3.7 times that of 1965 (see FBIS, May 19, 1976, K3) and that the average annual rate of growth between 1965 and 1977 was 11.4 percent. See BBC, FE/W962/A/7, Jan. 11, 1978.

January–June 1976: Derived from cumulative output through June 1977 and the statement that output in the 1st 7 months increased 6 percent over the corresponding period of 1976 on the assumption that the percentage increase through June was the same as the percentage increase through July. See NCNA, Peking, Aug. 30, 1977.

July–December 1976: Derived from cumulative output through December 1977 and the statement that output in 1977 increased 15.4 percent over that in 1976. See FBIS, Feb. 8, 1978, K3.

January–June 1977: Derived from the statement that 49 percent of the plan was fulfilled by the end of June. See FBIS, Aug. 10, 1977, K1.

July–December 1977: Estimated on the assumption that the plan was fulfilled by the end of the year.

TABLE B-6.—MONTHLY INDUSTRIAL OUTPUT IN HUNAN, 1974–77

[Planned output in 1977=100]

	Cumulative output since Jan. 1	Output in period	
		Total	Monthly average
1974:			
January–June	34.1	34.1	5.7
July–December	92.5	58.4	9.7
1975:			
January–June	44.0	44.0	7.3
July–December	92.5	48.5	8.1
1976:			
January–June	45.8	45.8	7.6
July–September	70.4	24.6	8.2
October–December	94.1	23.7	7.9
1977:			
January	6.0	6.0	6.0
February	12.0	6.0	6.0
March	19.4	7.4	7.4
April	28.2	8.8	8.8
May	39.5	11.3	11.3
June	52.0	12.5	12.5
July–September	84.0	32.0	10.7
October	95.4	11.4	11.4
November	105.5	10.1	10.1
December	115.6	10.1	10.1

Sources:

January–June 1974: Derived from cumulative output through June 1975 and the statement that output in the 1st half of 1975 increased 29 percent over the corresponding period of 1974. See FBIS, July 14, 1975, H3.

July–December 1974: Derived from cumulative output through December 1975 and the statements that output in 1974 was 29 times that of 1949 (see FBIS, Feb. 3, 1975, H3) and that output in 1975 was 29 times that of 1949 (see “Peking Review, No. 30, 1976, p. 19).

January–June 1975: Derived from cumulative output through June 1976 and the statement that output in the 1st half of 1976 increased 4 percent over the corresponding period of 1975. See FBIS, Aug. 2, 1976, H11.

July–December 1975: Derived from cumulative output through December 1976 and the statements that output in 1975 was 29 times that of 1949 (see Peking Review, No. 30, 1976, p. 19) and that output in 1976 was 29.5 times that of 1949 (see FBIS, July 13, 1977, G6).

January–June 1976: Derived from cumulative output through June 1977 and the statement that output in the 1st half of 1977 increased 13.5 percent over the corresponding period of 1976. See BBC, FE/W939/A/4, July 27, 1977.

July–September 1976: Derived from cumulative output through September 1977 and the statement that output in the 1st 9 months of 1977 increased 19.25 percent over the corresponding period of 1976. See FBIS, Oct. 14, 1977, H5.

October–December 1976: Derived from cumulative output through December 1977 and the statement that output in 1977 increased 22.9 percent over that in 1976. See FBIS, Jan. 12, 1978, H1.

January–June 1977: Derived from the statement that 52 percent of the plan was fulfilled by the end of June. See BBC, FE/W939/A/4, July 27, 1977. The individual months were derived from the following increases over the preceding month:

	Percentage increase	Index (January=100)	Source
January		100.0	
February	0	100.0	Assumed.
March	23.3	123.3	Estimated.
April	18.0	145.5	FBIS, July 13, 1977, E17.
May	28.9	187.5	Ibid.
June	10.0	206.3	Assumed.

Note: The rate of growth in March was estimated subject to the constraint that output in the 2d quarter be 68 percent greater than in the 1st quarter. See BBC, FE/W939/A/4, July 27, 1977.

July–September 1977: Derived from the statement that 84 percent of the plan was fulfilled by the end of September. See BBC, FE/W954/A/8, Nov. 9, 1977.

October 1977: Derived from the statement that 95.4 percent of the plan was fulfilled by the end of October. See FBIS, Nov. 17, 1977, H1.

November 1977: Derived as the difference between cumulative output through December and output in the month of December.

December 1977: Cumulative output through December was derived from the statement that 115.6 percent of the plan was fulfilled by the end of December (see FBIS, Jan. 12, 1978, H1). Output in the month of December was estimated from cumulative output through December and the statement that the plan was fulfilled 48 days early on the assumption that average daily output was the same in late November and December (see NCNA, Changsha, Dec. 26, 1977).

TABLE B-7.—MONTHLY INDUSTRIAL OUTPUT IN HUPEH, 1976–77

[Planned output in 1977=100]

	Cumulative output since Jan. 1	Output in period	
		Total	Monthly average
1976:			
January–June	45.8	45.8	7.6
July–September	68.4	22.6	7.5
October–December	97.5	29.1	9.7
1977:			
January	4.8	4.8	4.8
February	9.6	4.8	4.8
March	17.1	7.5	7.5
April	26.1	9.0	9.0
May	36.8	10.7	10.7
June	48.8	12.0	12.0
July–September	82.8	34.0	11.3
October–November	106.0	23.2	11.6
December	117.6	11.6	11.6
1978: January–February	17.3	17.3	8.7

Sources:

January–June 1976: Derived as the difference between cumulative output through September 1976 and output in the months July through October.

July–September 1976: Cumulative output through September was derived from cumulative output through September 1977 and the statement that output in the 1st 9 mo increased 21 percent over the corresponding period of 1976 (see JMJP, Nov. 2, 1977). Output in the 3d quarter was derived from output in the 4th quarter 1976 and the statement that output in the 4th quarter increased 28.8 percent over the 3d quarter. (See BBC, FE/W918/A/9, Mar. 2, 1977).

October–December 1976: Derived from cumulative output through December 1977 and the statement that output in 1977 increased 20.6 percent over 1976. See FBIS, Jan. 16, 1978, H2.

January–June 1977: Derived from the statement that 48.8 percent of the plan was fulfilled by the end of June (see FBIS, July 6, 1977, H4). The individual months were derived from the following increases over the preceding months:

	Percentage increase	Index (January=100)	Source
January		100.0	
February	0	100.0	Assumed.
March	57.6	157.6	FBIS, Oct. 4, 1977, H1.
April	20.2	189.4	FBIS, June 7, 1977, H1.
May	18.9	225.2	FBIS, FE/W935/A/9, June 29, 1977.
June	11.9	252.0	Radio Wuhan, July 12, 1977.

July–September 1977: Derived from the statement that 82.8 percent of the plan was fulfilled by the end of September. See JMJP, Nov. 2, 1977.

October–November 1977: Derived from the statement that 106 percent of the plan was fulfilled by the end of November. See FBIS, Dec. 15, 1977, H5.

December 1977: Assumed to be the same in October–November 1977.

January–February 1978: Derived from the statement that output in the 1st 2 mo of the year increased 80 percent over the corresponding period of 1977. See FBIS, Apr. 4, 1978, H12.

TABLE B-8.—MONTHLY INDUSTRIAL OUTPUT IN INNER MONGOLIA, SELECTED MONTHS, 1976–77

[Planned output in 1977=100]

	Cumulative output since Jan. 1	Output in period	
		Total	Monthly average
1976: January–October	75.2	75.2	7.5
1977:			
January–June	48.0	48.0	8.0
July–October	83.1	35.1	8.8

Sources:

January–October 1976: Derived from cumulative output through October 1977 and the statement that output in the 1st 10 mo increased 10.5 percent over the corresponding period of 1976. See FBIS, Nov. 22, 1977, K3.

January–June 1977: Derived from the statement that 48 percent of the plan was fulfilled by the end of June. See BBC, FE/W941/A/10, Aug. 10, 1977.

July–October 1977: Derived from the statement that 83.1 percent of the plan was fulfilled by the end of October. See FBIS, Nov. 22, 1977, K3.

TABLE B-9.—MONTHLY INDUSTRIAL OUTPUT IN KIANGSI, SELECTED MONTHS, 1976-77

[Planned output in 1977=100]

	Cumulative output since Jan. 1	Output in period	
		Total	Monthly average
1976:			
January-July	46.8	46.8	6.7
August	53.4	6.6	6.6
September-October	65.6	12.2	6.1
1977:			
January	4.8	4.8	4.8
February	9.6	4.8	4.8
March	16.6	7.0	7.0
April	24.9	8.3	8.3
May	34.1	9.2	9.2
June	44.3	10.2	10.2
July	55.7	11.4	11.4
August	67.8	12.1	12.1
September	79.7	11.9	11.9
October	91.0	11.3	11.3
November	101.4	10.4	10.4

Sources:

January-July 1976: Derived as the difference between cumulative output through August 1976 and output in August 1976.

August 1976: Cumulative output through August was derived from cumulative output through August 1977 and the statement that output in the 1st 8 mo of 1977 increased 26.9 percent over the corresponding period of 1976. Output in August was derived from output in August 1977 and the statement that output in August 1977 increased 84.2 percent over August 1976. See FBIS, Sept. 26, 1977, G5.

September-October 1976: Derived from cumulative output through October 1977 and the statement that output in the 1st 10 mo of 1977 increased 38.7 percent over the corresponding period of 1976. See BBC, FE/W958/A/12, Dec. 7 1977.

January-August 1977: Derived from the statement that 67.8 percent of the plan was fulfilled by the end of June (see FBIS, Sept. 26, 1977, G5). The individual months were estimated from the following increases over the preceding month:

	Percentage increase	Index (January=100)	Source
January		100.0	
February	0	100.0	Assumed.
March	48	148.0	FBIS, May 2, 1977, G5.
April	18.2	174.9	FBIS, June 9, 1977, G5.
May	10.95	194.1	Estimated.
June	10.95	215.3	Do.
July	10.95	238.9	Do.
August	6.1	253.5	FBIS, Sept. 26, 1977, G5.

Note: The rate of growth in May, June and July (which was assumed to have been the same in each of the 3 mo) was estimated subiected to the constraint that output in the 2d quarter be 67.9 percent greater than in the 1st quarter. See FBIS, Aug. 16, 1977, G14.

September 1977: Derived from the statement that 79.7 percent of the plan was fulfilled by the end of September. See China News Service, Nanchang, Nov. 11, 1977.

October 1977: Derived from the statement that 91 percent of the plan was fulfilled by the end of October. See BBC, FE/W958/A/12, Dec. 7, 1977.

November 1977: Derived from the statement that the plan was fulfilled 35 days early on the assumption that average daily output was constant during the month. See FBIS, Jan. 6, 1978, G5.

TABLE B-10.—MONTHLY INDUSTRIAL OUTPUT IN KIANGSU, 1975-77

[Planned output in 1977=100]

	Cumulative output since Jan. 1	Output in period	
		Total	Monthly average
1975:			
January-June	39.1	39.1	6.5
July-December	93.9	54.8	9.1
1976:			
January-June	43.9	43.9	7.3
July-August	57.3	13.4	6.7
September	65.5	8.2	8.2
October	74.0	8.5	8.5
November-December	94.4	20.4	10.2
1977:			
January-June	50.5	50.5	8.4
July-August	67.3	16.8	8.4
September	76.3	9.0	9.0
October	86.9	10.6	10.6
November-December	110.9	24.0	12.0

Sources:

January-June 1975: Derived from cumulative output through June 1976 and the statement that output in the 1st half of 1976 increased 12.4 percent over the corresponding period of 1975. See FBIS, Aug. 18, 1976, G8.

July-December 1975: Derived from cumulative output through December 1976 and the calculated 0.5 percent increase in 1976. The percent increase was calculated from the statement that output in 1976 was 18.5 times that of 1949 (see FBIS, June 17, 1977, G3) and that output in 1975 was 18.4 times that of 1949 (see FBIS, Oct, 6, 1976, G9).

January-June 1976: Derived from cumulative output through June 1977 and the statement that output in the 1st half of 1977 increased 15.1 percent over the corresponding period of 1976. See FBIS, Aug. 16, 1977, G14.

July-August 1976: Derived from cumulative output through August 1977 and the statement that output in the 1st 8 mo increased 17.5 percent over the corresponding period of 1976. See BBC, FE/W951/A/6, Oct. 19, 1977

September 1976: Derived from cumulative output through September 1977 and the statement that output in the 1st 9 mo increased by 16.5 percent over the corresponding period of 1976. See BBC, FE/W951/A/6, Oct. 19, 1977

October 1976: Derived from cumulative output through October 1977 and the statement that output in the 1st 10 mo increased 17.4 percent over the corresponding period of 1976. See FBIS, Dec. 6, 1977, G5.

November-December 1976: Derived as the difference between output in the 4th quarter and output in October. Output in the 4th quarter was derived from the sum of output in July-August and September and from the statement that output in the 4th quarter increased 34 percent over the 3d quarter. See BBC, FE/W933/A/6, June 15, 1977.

January-June 1977: Derived from the statement that 50.5 percent of the plan was fulfilled by the end of June. See FBIS, Aug. 16, 1977, G14.

July-August 1977: Derived from the statement that 67.3 percent of the plan was fulfilled by the end of August. See BBC, FE/W951/A/6, Oct. 19, 1977.

September 1977: Derived from the statement that 76.3 percent of the plan was fulfilled by the end of September, See BBC, FE/W951/A/6, Oct. 19, 1977.

October 1977: Derived from the statement that 86.9 percent of the plan was fulfilled by the end of October. See FBIS, Dec. 6, 1977, G5.

November-December 1977: Derived from cumulative output through December 1976 and the statement that output in 1977 increased 17 5 percent over 1976. See FBIS, Jan. 16, 1978, G8.

TABLE B-11.—MONTHLY INDUSTRIAL OUTPUT IN KWANGSI, 1976-77

[Planned output in 1977=100]

	Cumulative output since Jan. 1	Output in period	
		Total	Monthly average
1976: January-December	90.1	90.1	7.5
1977: January-December	106.0	106.0	8.8

Sources:

January-December 1976: Derived from cumulative output through December 1977 and the statement that output in 1977 increased 17.6 percent over that in 1976. See BBC, FE/W965/A/5, Feb. 1, 1978.

January-December 1977: Derived from the statement that 106 percent of the plan was fulfilled by the end of December. See BBC, FE/W965/A/5, Feb. 1, 1978.

TABLE B-12.—MONTHLY INDUSTRIAL OUTPUT IN KWEICHOW, SELECTED MONTHS, 1975–78

[Planned output in 1977=100]

	Cumulative output since Jan. 1	Output in period	
		Total	Monthly average
1975:			
January–August	55.4	55.4	6.9
September	64.4	9.0	9.0
October–December	93.1	28.7	9.6
1976:			
January–June	39.3	39.3	6.6
July	45.2	5.9	5.9
August–October	66.4	21.2	7.1
November–December	81.7	15.2	7.6
1977:			
January	7.2	7.2	7.2
February	11.9	4.7	4.7
March	19.0	7.0	7.1
April	27.7	8.7	8.7
May	38.6	10.9	10.9
June	50.8	12.2	12.2
July	60.7	9.9	9.9
August	71.7	11.0	11.0
September	84.5	12.8	12.8
October	95.9	11.4	11.4
November	108.3	12.4	12.4
December	121.9	13.6	13.6
1978: January	14.6	14.6	14.6

Sources:

January–August 1975: Derived as the difference between cumulative output through September 1975 and output in September 1975.

September 1975: Cumulative output through September was derived from cumulative output through September 1977 and the statement that output in the 1st 9 mo increased 31.3 percent over the corresponding period of 1975, the previous peak (see FBIS, Oct. 25, 1977, G1). Output in September was derived from output in May 1977 and the statement that output in May 1977 increased 21.7 percent over September 1975, the previous peak month (see BBC, FE/W937/A/10, July 13, 1977).

October–December 1975: Derived from cumulative output through December 1977 and the statement that output increased 31 percent over the record level. See FBIS, Mar. 2, 1978, J1.

January–June 1976: Derived from cumulative output through June 1977 and the statement that output in the 1st half of 1977 increased 29.2 percent over the corresponding period of 1976. See FBIS, July 13, 1977, J13.

July 1976: Derived from output in July 1977 and the statement that output in July 1977 increased 67.7 percent over July 1976. See FBIS, Oct. 6, 1977, J4.

August–October 1976: Derived from cumulative output through October 1977 and the statement that output in the 1st 10 mo of 1977 increased 44.5 percent over the corresponding period of 1976. See FBIS, Nov. 23, 1977, J3.

November–December 1976: Derived from cumulative output through December 1975 and the 12.25 percent decline calculated from the statement that the 1977 plan was fulfilled 50 days ahead of schedule, an increase of 8.2 percent over 1975 and 23.3 percent over 1976. See China News Service, Kweiyang, Nov. 19, 1977.

January 1977: Derived from output in January 1978 and the statement that output in January 1978 increased 103 percent over January 1977. See FBIS, Feb. 14, 1978, J2.

February–May 1977: Derived as the difference between cumulative output through June 1977 and the sum of output in January 1977 and June 1977. The individual months were derived from the following increases over the preceding month:

	Percentage increase	Index (February=100)	Source
February		100.0	
March	48.8	148.8	FBIS, June 8, 1977, E7.
April	23.3	183.5	Ibid.
May	25.8	230.8	Ibid.

June 1977: Cumulative output through June 1977 was derived from the statement that 50,8 percent of the plan was fulfilled by the end of June (see FBIS, Oct. 6, 1977, J4). Output in June 1977 was derived from output in September 1977 increased 4.6 percent over June 1977, the previous peak (see BBC, FE/W952/A/10, Oct. 26, 1977).

July–September 1977: Derived from the statement that 84.5 percent of the plan was fulfilled by the end of September (see BBC, FE/W/952/A/10, Oct. 26, 1977). The individual months were derived from the following increases over the preceding month:

	Percentage increase	Index (January=100)	Source
July		100.0	
August	11.2	111.2	FBIS. Nov. 3, 1977, J1.
September	16.5	129.5	BBC, FE/W952/A/10, Oct. 26, 1977.

October 1977: Estimated to be $^{31}/_{42}$ds of the output for the period October 1977 through Nov. 11, 1977, when the plan was fulfilled. See Peking Review, No. 51, 1977, p. 30.

November 1977: Derived as the difference between cumulative output through December 1977 and output in the month of December.

December 1977: Cumulative output through December 1977 was derived from the statement that 121.9 percent of the plan was fulfilled by the end of December (see FBIS, Feb. 17, 1978, J6). Output in the month of December was estimated to be $^{31}/_{50}$ths of the output for the period from Nov. 12, 1977, through the end of the year (see Peking Review, No. 51, 1977, p. 30).

January 1978: Derived from the statement that output in the month of January 1978 increased 7.3 percent over December 1977. See FBIS, Feb. 14, 1978, J2.

TABLE B-13.—MONTHLY INDUSTRIAL OUTPUT IN LIAONING, SELECTED MONTHS, 1977

[Planned output in 1977=100]

	Cumulative output since Jan. 1	Output in period	
		Total	Monthly average
1977:			
January	6.8	6.8	6.8
February	13.6	6.8	6.8
March	21.6	8.0	8.0
April	30.1	8.5	8.5
May	39.4	9.3	9.3
June	50.0	10.6	10.6
1978: January–February	17.1	17.1	8.6

Sources:

January–June 1977: Assumed that 50 percent of the plan was fulfilled by the end of June. The individual months were derived from the following increases over the preceding month:

	Percentage increase	Index (January=100)	Source
January		100.0	
February		100.0	Assumed.
March	18.1	118.1	BBC, FE/W931/A/5, June 1, 1977.
April	6.1	125.3	JMJP, July 16, 1977.
May	8.5	136.0	Ibid.
June	14.5	155.7	Ibid.

January–February 1978: Derived from the statement that output in the 1st 2 mo increased 26 percent over the corresponding period of 1977. See FBIS, Mar. 24, 1978, L7.

TABLE B-14.—MONTHLY INDUSTRIAL OUTPUT IN PEKING, SELECTED MONTHS, 1976–77

[Planned output in 1977=100]

	Cumulative output since Jan. 1	Output in period	
		Total	Monthly average
1976:			
May		8.3	8.3
June		8.9	8.9
1977:			
January–March	12.9	21.9	7.3
April	30.6	8.7	8.7
May	40.1	9.5	9.5
June	50.0	9.9	9.9
1978: January–March	28.6	28.6	9.5

Sources:

May 1976: Derived from output in May 1977 and the statement that output in May 1977 increased 14.6 percent over May 1976. See FBIS, June 14, 1977, K2.

June 1976: Derived from output in June 1977 and the statement that output in June increased 11 percent over June 1976. See JPRS, No. 69898, Oct. 3, 1977, p. 15.

January–March 1977: Derived from output in the 1st half of 1977 and the statement that output in the 2d quarter increased 27.8 percent over the 1st quarter. See JMJP, July 28, 1977.

April–June 1977: Assumed that 50 percent of the plan was fulfilled by the end of June. Output in the period April–June was derived as the difference between cumulative output through June and output in the period January–March. The individual months were estimated from the following increases over the preceding month:

	Percentage increase	Index (April=100)	Source
April		100.0	
May	8.4	108.4	FBIS, June 14, 1977. K2.
June	4.6	113.4	JPRS, No. 68898, Oct. 3, 1977, p. 15.

January–March 1978: Derived from the statement that output in the 1st 3 mo increased 30.7 percent over the corresponding period of 1977. See CNS, Peking, Apr. 5, 1978.

TABLE B-15.—MONTHLY INDUSTRIAL OUTPUT IN SHANGHAI, SELECTED MONTHS, 1976–77

[Planned output in 1977=100]

	Cumulative output since Jan. 1	Output in period	
		Total	Monthly average
1976: January–September	66.9	66.9	7.4
1977:			
January	7.5	7.5	7.5
February	13.7	6.2	6.2
March	22.5	8.8	8.8
April–June	50.3	27.8	9.3
July–September	80.3	30.0	10.0
1978:			
January–February	18.9	18.9	9.4
March	29.6	10.7	10.7

Sources:

January–September 1976: Derived from cumulative output through September 1977 and the statement that output in the 1st 9 mo increased by 20 percent over the corresponding period of 1976. See TKP (HK), Oct. 20, 1977.

January–March 1977: Derived from cumulative output in the 1st half of 1977 and the statement that output in the 2d quarter increased 23.1 percent over the 1st quarter (see FBIS, July 15, 1977, G12). Individual months were derived from the following percentage increases:

	Percentage increase		Index (January=100)
	Over January	Over February	
January			100.0
February			82.8
March	18.4	43	118.4

Note: See "Learn From Taching," p. 97

April-June 1977: Derived from the statement that 50.3 percent of the plan was fulfilled by the end of June. See NCNA, July 21, 1977.

July-September 1977: Estimated on the basis of the statement that output in the 3d quarter exceeded that of the 2d quarter. See BBC, FE/W956/A/3, Nov. 23, 1977.

January-February 1978: Derived from the statement that output in the 1st 2mo increased by 37.6 percent over the corresponding period of 1977. See FBIS, Mar. 23, 1978, G11.

March 1978: Derived from the statement that output in the 1st 3 mo increased 31.5 percent over the corresponding period of 1977. See FBIS, Apr. 10, 1978, G3.

TABLE B-16.—MONTHLY INDUSTRIAL OUTPUT IN SHANSI, SELECTED MONTHS, 1976–77

[Planned output in 1977=100]

	Cumulative output since Jan. 1	Output in period	
		Total	Monthly average
1976:			
January–September	67.1	67.1	7.5
October–November	80.7	13.6	6.8
1977:			
January–June	51.4	51.4	8.6
July-September	81.1	29.7	9.9
October–November	102.1	21.0	10.5

Sources:

January–September 1976: Derived from cumulative output through September 1977 and the statement that output in the 1st 9 mo increased 20.9 percent over the corresponding period of 1976. See FBIS, Nov. 22, 1977, K3.

October–November 1976: Derived from cumulative output through Nov. 24, 1977, and the statement that output increased 26 percent over the corresponding period of 1976 .See FBIS, Dec. 28, 1977, K3.

January–June 1977: Derived from the statement that 51.4 percent of the plan was fulfilled by late June. See FBIS July 22, 1977, K8.

July–September 1977. Derived from the statement that 81.1 percent of the plan was fulfilled by the end of September. See FBIS, Nov. 22, 1977, K3.

September–November 1977: Derived from the statement that the plan was fulfilled 37 days ahead of schedule. See FBIS, Dec. 28, 1977, K3.

TABLE B-17.—MONTHLY INDUSTRIAL OUTPUT IN SHANTUNG, SELECTED MONTHS, 1975–77

[Planned output in 1977=100]

	Cumulative output since Jan. 1	Output in period	
		Total	Monthly average
1975: January–June	31.9	31.9	5.3
1976:			
January–June	42.7	42.7	7.1
July	49.6	6.9	6.9
August	56.5	6.9	6.9
September	65.7	9.2	9.2
October–November	81.5	15.9	8.0
1977:			
January–June	49.6	49.6	8.3
July	58.7	9.1	9.1
August	68.2	9.5	9.5
September	78.8	10.6	10.6
October–November	100.0	21.2	10.6

Sources:

January–June 1975: Derived from cumulative output through June 1976 and the statement that output in this 1st half of 1976 increased 34 percent over the corresponding period of 1975. See FBIS, Aug. 6, 1976, G7.

January–June 1976: Derived from cumulative output through June 1977 and the statement that output in the 1st half of 1977 increased 16.2 percent over the corresponding period of 1976. See FBIS, Sept. 20, 1977, J2.

July 1975: Derived as the difference between cumulative output through August 1976 and the sum of output in January–June and August.

August 1976: Cumulative output through August was derived from cumulative output through August 1977 and the statement that output in the 1st 8 mos of 1977 increased 20.8 percent over the corresponding period of 1976 (see BBC, FE/W950/A/15, Oct. 12, 1977). Output in August was derived from output in August 1977 and the statement that output in August 1977 increased 37 percent over August 1976 (see FBIS, Sept. 20, 1977, J2).

September 1976: Derived from cumulative output through September 1977 and the statement that output in the 1st 9 mo increased 20 percent over the corresponding period of 1976 See BBC, FE/W952/A/10, Oct. 26, 1977.

October–November 1976: Derived from the statement that cumulative output through November 1977 and the statement that output in the 1st 11 mo increased 22.7 percent over the corresponding period of 1976. See Tsinan Provincial Service, Dec. 7, 1977.

January–June 1977: Derived from the statement that 49.6 percent of the plan was fulfilled by the end of June. See Chung-kuo hsin-wen, July 15, 1977.

July 1977: Derived from output in July–August and the statement that output in August 1977 increased 4.7 percent over July 1977 (see FBIS, Sept. 20, 1977, J2). Output in July–August was derived as the difference between cumulative output through August 1977 and cumulative output through June 1977.

August 1977: Cumulative output through August was derived from the statement that 68.2 percent of the plan was fulfilled by the end of August (see BBC, FE/W950/A/15, Oct. 12, 1977). Output in August was derived as the difference between cumulative output through August and the sum of output in January–June and July.

September 1977: Derived from the statement that 78.75 percent of the plan was fulfilled by the end of September. See FBIS, Nov. 14, 1977, E7.

October–November 1977: Derived from the statement that the plan was fulfilled by the end of November. See Tsinan Provincial Service, Dec. 7, 1977.

TABLE B-18.—MONTHLY INDUSTRIAL OUTPUT IN SHENSI, SELECTED MONTHS, 1973 AND 1975–77

[Planned output in 1977=100]

	Cumulative output since Jan. 1	Output in period	
		Total	Monthly average
1973: January–October	80.5	80.5	8.0
1975: January–October	69.7	69.7	7.0
1976:			
January–August	61.0	61.0	7.6
September–October	75.3	14.3	7.2
November–December	94.0	18.7	9.4
1977:			
January–August	65.5	65.5	8.2
September–October	86.5	21.0	10.5
November–December	107.7	21.2	10.6

Sources:

January–October 1973: Derived from cumulative output through October 1977 and the statement that output in the 1st 10 mo increased 7.4 percent over the corresponding period of the peak year, here assumed to be 1973. See FBIS, Nov. 25, 1977, M1.

January–October 1975: Derived from cumulative output through October 1977 and the statement that output in the 1st 10 mo of 1977, increased 24.1 percent over the corresponding period of 1975. See FBIS, Nov. 25, 1977, M1.

January–August 1976: Derived from cumulative output through August 1977 and the statement that output increased 7.4 percent over the corresponding period of 1977. See BBC, FE/W952/A/10, Oct. 26, 1977.

September–October 1976: Derived from cumulative output through October 1977 and the statement that output increased 14.8 percent over the corresponding period of 1977. See FBIS, Nov. 25, 1977, M1.

November–December 1976: Derived from cumulative output through December 1977 and the statement that output increased 14.6 percent over that in 1976. See FBIS, Feb. 6, 1978, M9, as corrected.

January–August 1977: Derived from the statement that 65.5 percent of the plan was fulfilled by the end of August. See BBC, FE/W952/A/10, Oct. 26, 1977.

September–October 1977: Derived from the statement that 86.5 percent of the plan was fulfilled by the end of October. See FBIS, Nov. 25, 1977, N1.

November–December 1977: Derived from the statement that 107.7 percent of the plan was fulfilled by the end of December. See FBIS, Feb. 6, 1978, M9, as corrected.

TABLE B-19.—MONTHLY INDUSTRIAL OUTPUT IN SINKIANG, 1976–77

[Planned output in 1977=100]

	Cumulative output since Jan. 1	Output in period	
		Total	Monthly average
1976:			
January–August	58.3	58.3	7.3
September–December	96.0	37.7	9.4
1977:			
January–August	68.3	68.3	8.5
September–December	107.3	39.0	9.8

Sources:

January–August 1976: Derived from cumulative output through August 1977 and the statement that output in the 1st 8 mo of 1977 increased 17.17 percent over the corresponding period of 1976. See FBIS, Oct. 14, 1977, M9.

September–December 1976: Derived from cumulative output through December 1977 and the statement that output in 1977 increased 11.72 percent over that in 1976. See FBIS, Feb. 7, 1978, M4.

January–August 1977: Derived from the statement that 68.3 percent of the plan was fulfilled by the end of August. See FBIS, Oct. 14, 1977, M9.

September–December 1977: Derived from the statement that 107.27 percent of the plan was fulfilled by the end of December. See FBIS, Feb. 7, 1978, M4

TABLE B-20.—MONTHLY INDUSTRIAL OUTPUT IN SZECHWAN, SELECTED MONTHS, 1976–78

[Planned output in 1977=100]

	Cumulative output since Jan. 1	Output in period	
		Total	Monthly average
1976:			
January–April	29.3	29.3	7.3
May	37.5	8.2	8.2
June	46.8	9.3	9.3
July–August	60.0	13.2	6.6
September	64.5	4.5	4.5
October	69.4	4.9	4.9
November	75.3	5.9	5.9
1977:			
January	5.8	5.8	5.8
February	12.0	6.2	6.2
March	20.2	8.2	8.2
April	29.3	9.1	9.1
May	39.7	10.4	10.4
June	51.5	11.8	11.8
July–August	73.1	21.6	10.8
September	83.0	9.9	9.9
October	95.9	12.9	12.9
1978: January	10.1	10.1	10.1

Sources:

January–April 1976: Derived as the difference between cumulative output through June and the sum of output in May and June.

May 1976: Derived from output in May 1977 and the statement that output in May 1977 increased 27.3 percent over May 1976. See FBIS, June 30, 1977, J3.

June 1976: Cumulative output through June 1976 was derived from cumulative output through June 1977 and the statement that output in the 1st 6 mo increased 10 percent over the corresponding period of 1976 (see FBIS, Aug. 15, 1977, J3). Estimated from output in June 1977 on the assumption that the percentage increase over June 1976 was the same as the percentage increase for May 1977 over May1976.

July–August 1976: Derived as the difference between output in the period July–September and output in September.

September 1976: Cumulative output through September 1976 was derived from cumulative output through September 1977 and the statement that output in the 1st 9 mo increased 28.7 percent over the corresponding period of 1976 (see JMJP, Nov. 3, 1977). Output in September 1976 was derived from output in October 1976 and the statement that output in October increased 8.8 percent over September 1976. See FBIS, Jan. 5, 1977, J4.

October–November 1976: Cumulative output through Nov. 10 was derived from cumulative output through Nov. 10, 1977, and the statement that output increased 40 percent over the corresponding period of 1976 (see FBIS, Dec. 2, 1977). Output in the months October and November was estimated from total output in the period October–Nov. 10 and from the monthly increase in November of 20.5 percent (see FBIS, Jan. 5, 1977, J4) on the assumption that average daily output was constant in November. The equation for calculating the estimates are:

$$\text{Oct.}+\frac{10}{30}\,\text{Nov.}=6.9$$
$$\text{Nov.}=1.205\ \text{Oct.}$$

January–June 1977: Derived from the statement that 51.5 percent of the plan was fulfilled by the end of June (see JMJP, July 19, 1977). The individual months were derived from the following increases over the preceding month:

	Percentage increase	Index (January=100)	Source
January		100.0	
February	7.2	107.2	BBC, FE/W924/A/3, Apr. 13, 1977.
March	33.7	143.3	FBIS, May 10, 1977, J3.
April	11.0	159.1	FBIS, May 17. 1977, E7.
May	14.2	181.7	FBIS, June 30, 1977, J3.
June	13.4	206.0	FBIS, Aug. 15, 1977, J3.

July–August 1977: Derived from cumulative output through August 1976 and the statement that output in the 1st 8 mo of 1977 increased 21.9 percent over the corresponding period of 1976. See FBIS, Oct. 7, 1977, J1.

September 1977: Derived from the statement that 83 percent of the plan was fulfilled by the end of September. See "Peking Review," No. 47, 1977, p. 11.

October 1977: Derived from the statement that the plan was fulfilled on Nov. 10, 1977, on the assumption that average daily output remained constant during the period. See FBIS, Dec. 10, 1977, J5.

January 1978: Derived from output in the month of January 1977 and the statement that output in January 1978 increased 73.3 percent over that of January 1977. See FBIS, Feb. 23, 1978, J4.

TABLE B-21.—MONTHLY INDUSTRIAL OUTPUT IN TSINGHAI, SELECTED MONTHS, 1976–77

[Planned output in 1977=100]

	Cumulative output since Jan. 1	Output in period	
		Total	Monthly average
1976:			
January–June	43.4	43.4	7.2
July–September	60.5	17.1	5.7
1977:			
January–June	46.3	46.3	7.7
July–September	75.0	28.7	9.6

1976:
Sources:

January–June 1976: Derived from cumulative output through June 1977 and the statement that output in the 1st half of 1977 increased 6.8 percent over the corresponding period of 1976. See FBIS, Aug. 11, 1977, M8.

July–September 1976: Derived from cumulative output through September 1977 and the statement that output in the 1st 9 mo increased 24 percent over the corresponding period of 1976. See FBIS Oct. 14, 1977, M13.

January–June 1977: Derived from the statement that 46.3 percent of the plan was fulfilled by the end of June. See FBIS, Aug. 11, 1977, M8.

July–September 1977: Derived from the statement that 75 percent of the plan was fulfilled by the end of September, See FBIS, Oct. 14, 1977, M13.

TABLE B-22.—MONTHLY INDUSTRIAL OUTPUT IN YUNNAN, SELECTED MONTHS, 1975–77

[Planned output in 1977=100]

	Cumulative output since Jan. 1	Output in period	
		Total	Monthly average
1975: January–November	101.6	101.6	9.2
1976:			
January–June	41.9	41.9	7.0
July–September	62.2	20.3	6.8
October–November	77.4	15.2	7.6
December	84.6	7.2	7.2
1977:			
January–June	51.5	51.5	8.6
July–September	86.2	34.7	11.6
October–November	110.2	24.0	12.0
December	123.3	13.1	13.1
1978: January–March	37.9	37.9	12.6

Sources:

January–November 1975: Derived from cumulative output through November 1977 and the statement that output in the 1st 11 mo of 1977 increased 8.5 percent over the corresponding period of 1975. See FBIS, Dec. 21, 1977, J5.

January–June 1976: Derived from cumulative output through June 1977 and the statement that output in the 1st half of 1977 increased 22.9 percent over the corresponding period of 1976. See FBIS, July 14, 1977, J7.

July–September 1976: Derived from cumulative output through September 1977 and the statement that output in the 1st 9 mo of 1977 increased 38.6 percent over the corresponding period of 1976. See China News Service, Kunming, Nov. 14, 1977.

October–November 1976: Derived from cumulative output through November 1977 and the statement that output in the 1st 11 mo increased 42.4 percent over the corresponding period of 1976. See Radio Kunming, Dec. 1, 1977.

December 1976: Derived from the statement that the plan was fulfilled in mid-November and that output increased 18.6 percent over that for the entire year 1976. See China News Service, Kunming, Dec. 1, 1977.

January–June 1977: Derived from the statement that 51.5 percent of the plan was fulfilled by the end of June. See FBIS, July 14, 1977, 57.

July–September 1977: Derived from the statement that 86.2 percent of the plan was fulfilled by the end of September. See China News Service, Kunming, Nov. 14, 1977.

October–November 1977: Derived from the statement that 110.2 percent of the plan was fulfilled by the end of November. See FBIS, Dec. 21, 1977, J5.

December 1977: Derived from the statement that 123.3 percent of the plan was fulfilled by the end of December. See FBIS, Feb. 22, 1978, J5.

January–March 1978: Derived from the statement that output in the 1st 3 mo of 1978 increased 2.2 percent over the 4th quarter of 1977. See FBIS, Apr. 13, 1978, J3.

Appendix C. Provincial and Regional Industrial Output, 1965–1977

The provincial GVIO data presented in Table C–1 were derived in CIA, "The Gross Value of Industrial Output in the People's Republic of China," June 1978. Although only two or three figures for the absolute value of provincial industrial output have been released for the years since the collapse of the Leap Forward, it was possible to use a least squares technique to approximate the unpublished time-series from statements about increases over 1949, 1965, or the previous year. This technique is fully described in Appendix A of Field, Lardy, and Emerson, 1976.

The regional GVIO data presented in Table C–2 were derived from the provincial output data in Table C–1 by the method described in CIA, "The Gross Value of Industrial Output in the People's Republic of China: 1965–1977," June 1978. The method differs from that used in Field, Lardy, and Emerson, 1976, in two respects. First, the provincial GVIO data are weight so that years for which the data are more complete weigh more heavily in the calculations than those for which data are sparce. And second, the value for any given year can be forced to equal a reported figure or a figure derived from reported data.

Because the method only approximates the underlying data, the regional GVIO series were forced to equal the estimated national total.

TABLE C-1.—GROSS VALUE OF INDUSTRIAL OUTPUT, BY PROVINCE, 1965-77

[Million 1957 yuan]

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Northeast:													
Heilungkiang	7,971	9,885		8,727	10,821	12,639	13,284	13,098	14,922	15,785	17,815	18,563	20,698
Kirin	5,138	6,344			6,254	7,517	8,014	9,434		9,378	10,844	11,237	
Liaoning	18,900	21,586		16,230	24,020	29,232	32,810	34,713	37,944	40,727	43,653		
North:													
Peking	5,602	6,767		6,345	9,068	12,079	14,483	15,685	16,914	18,569	19,607	20,167	20,727
Tientsin	6,882			7,684	9,835	12,097	13,738	14,703	16,031	17,524	18,748		
Hopeh	6,723					13,445	14,534	18,039	20,168	22,648	24,873	21,279	24,556
Shansi										6,264			
Inner Mongolia	3,009	3,321				4,487	5,452	6,018		6,018			
East:													
Shanghai	24,163	27,787		29,542	33,974	39,002	42,848	46,236	49,905	52,892	56,030	56,663	61,536
Shantung	6,174				9,191	12,565	14,324	15,682	16,198	20,374	20,932	24,796	30,339
Kiangsu	7,865			9,201	13,106	15,796	18,881	18,520	20,611	23,435	27,465	27,615	32,447
Chekiang	3,902			4,813	5,295	6,068	6,881	7,809	8,736	7,805		6,898	9,362
Anhwei	2,409	3,084		2,035	2,945	3,828	4,707	5,291	6,137	6,149	7,330	7,809	
Kiangsi				2,675	3,004					5,242			
Fukien	1,832	2,207			2,025	2,531	2,812	3,194	2,577	4,325	4,720		
Central—South:													
Honan	3,988	5,168			5,843	7,654	9,022	10,710		11,323	12,761	10,710	
Hupeh	4,140	5,133		3,704	5,000	7,500	8,738			9,238		10,337	12,451
Hunan	2,915	3,688		2,705	3,990	5,825	6,384	6,996	7,979	8,284	8,284	8,427	10,357
Kwangsi	1,308	1,635			1,975	2,433	3,022	3,524	4,082	4,528	5,063	5,246	6,173
Kwangtung	7,735	9,283		7,848	10,648	12,553	13,228	14,061	15,968	17,195	19,929	20,928	22,602
Northwest:													
Kansu	2,172		2,097	2,760	3,505	4,381	5,591	5,931	6,298	6,769	7,732	7,757	8,579
Shensi	2,898	4,141				5,917	6,857	7,696	8,570	6,517	7,215	7,921	9,978
Ningsia	76	86						306	344	359	424		
Tsinghai	344	477		394	543	699	898	1,018	1,155	1,259	1,385	1,694	1,957
Sinkiang	1,152	1,448		1,351	1,486	1,526		1,861		1,861		1,927	2,152
Southwest:													
Szechwan	6,929						11,424	11,972	12,930	13,852	17,465	14,221	19,910
Yunnan	1,503	1,885		1,319	1,922	2,306	2,541	2,735	3,195	3,398	3,447	2,579	3,740
Kweichow	1,624	2,105							3,248	3,158	4,548	3,991	5,958
Tibet	26		25	37			50	61	72	89	109	111	125

Source: CIA, "The Gross Value of Industrial Output in the People's Republic of China: 1965-77", June 1978.

TABLE C-2.—GROSS VALUE OF INDUSTRIAL OUTPUT, BY REGION, 1965–66 AND 1968–77

	1965	1966	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Billion 1957 yuan:												
Northeast	31.1	37.8	29.7	40.6	48.6	52.0	56.8	61.9	64.1	69.7	73.3	81.9
North	25.1	30.3	28.6	38.4	49.0	55.1	63.2	70.0	74.5	80.6	82.5	89.4
East	47.4	61.0	59.7	68.8	81.9	90.8	98.9	109.0	116.5	126.1	131.9	149.7
Central—South	19.5	24.7	20.0	27.1	35.1	38.4	42.8	47.0	49.1	55.2	55.3	64.4
Northwest	6.5	9.6	8.1	9.8	12.6	15.2	16.6	18.9	16.5	18.8	19.8	22.3
Southwest	9.6	12.5	8.8	12.6	15.0	15.9	17.1	19.1	19.8	24.0	20.0	28.5
Total	139.3	175.9	154.7	197.3	242.2	267.5	295.4	326.0	340.5	374.3	382.7	436.3
Index (1965=100):												
Northeast	100	121	95	130	156	167	182	199	206	224	235	263
North	100	121	114	153	195	220	252	279	297	322	329	357
East	100	129	126	145	173	191	209	230	246	266	278	316
Central—South	100	127	102	139	180	197	219	241	252	282	283	330
Northwest	100	148	125	152	195	236	257	293	255	291	306	346
Southwest	100	130	91	130	156	165	177	198	205	249	208	296
Total	100	126	111	142	174	192	212	234	245	269	275	313

A SURVEY OF CHINA'S MACHINE-BUILDING INDUSTRY

By Jack Craig, Jim Lewek, and Gordon Cole

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ABBREVIATIONS

A	ampere
AC	alternating current
DC	direct current
DWT	deadweight tons
hp	horsepower
kg/cm^2	kilograms per square centimeter
kV	kilovolt
kW	kilowatt
m^3	cubic meter
mm	millimeter
m^3/min	cubic meters per minute
MVA	megavolt ampere
MW	megawatt
rpm	revolutions per minute

I. INTRODUCTION

Chinese leaders have frequently claimed that the machine-building industry is the key to technological transformation of the national economy. Indeed, the industry forms the foundation of China's military and industrial development—encompassing a broad spectrum of manufacturing trades, ranging from production of ball bearings to ships, locomotives, power-generation equipment, and the like. As outlined in Chairman Hua's report to the Fifth National People's Congress of early 1978 China is launching an ambitious program to revitalize the economy through modernization of agriculture, industry, national defense, and science and technology. The stated goal is to create a modern industrial economy by the year 2000. Much of the burden of achieving this goal will fall on the machine-building industry.

This paper provides an overview of the machine-building industry in the People's Republic, its development since 1949, organization, production, technological capabilities and limitations, planned reforms, and pitfalls likely to be encountered. The paper also provides brief descriptions of the main subsectors of the industry, giving their strengths and weaknesses and probable future development.

What conclusions can be drawn from the paper? Briefly, the technical capability of the Chinese machine-building industry, although impressively advanced since 1949, is still far below levels typical of the industrial West. Moreover, the quality of output and the inherent technology of the equipment vary widely from sector to sector.

How is the machine building industry organized and controlled? Most production falls under the jurisdiction of the First Ministry of Machine Building. The industry itself is made up of three types of enterprises: (a) those controlled solely by the central government; (b) those receiving dual supervision from central and local authorities; (c) and those solely under the control of local authorities but acting in accordance with general guidelines laid down by the central government. Administrative control over machine building plants involves a complex sharing of responsibilities among ministries, central and local planning bodies, bureaus and departments, and industrial enterprises.

How productive has China's machine-building industry been? Estimates are subject to a wide margin of error. The gross-value claims that have been published probably include military hardware as well as producer and consumer durables. Physical output data are available for only a few of the thousands of items produced by China's machine-building industry.

What is the technological capability of China's machine-building industry? The groundwork for the present technological capability was laid by the massive transfer of technology from the U.S.S.R. in the first decade of Communist rule. Products continue to reflect heavy influence of Soviet and East European design typical of the 1950's. Since the withdrawal of Soviet technical assistance, the Chinese have moved ahead from the Soviet base by the exploitation of Western technology through the import of complete plants and equipment, the culling of Western literature, the use of foreign technicians, and the training of Chinese abroad.

What problems have the Chinese recently had in running their machine-building factories? During much of the 1970's the industry suffered the fallout from the sever political factionalism that accompanied the struggle over the succession to Chairman Mao Tse-tung. Factionalism led to erosion of managerial authority, a slackening of factory discipline, massive slowdowns in production at many plants, and sometimes complete work stoppages. The net result of the chaos was poor quality, high costs, excessive consumption of raw materials, and high accident rates.

What broad industrial reforms can be anticipated that would improve performance of the machine-building industry? Vice Premier Teng Hsiao-ping outlined important changes in the "Twenty Points" issued prior to being purged in 1975. Many of his prescriptions for putting industry in general back on its feet have since become national policy, including a tightening of central control over the allocation of labor and raw materials, a new concern for profitability, increased quality standards, and stiffened managerial authority within the plant.

What pitfalls could hamper progress in the machine-building industry? The new emphasis on factory discipline could encounter severe resistance from a labor force accustomed to a leisurely work pace. Reforms cannot be accomplished all at once. For example, the plan to completely reorganize the farm machinery industry within 3 short years almost certainly will fail because of the lack of competent middle level managers and the underdeveloped transportation network. Moreover, China's ability to fully use, copy, or improve on large-scale purchases of advanced technology and equipment assigned to the machine-building industry is seriously limited, partly because of the 10-year gap in the training of high-level scientific researchers and engineers.

II. Overview of the Machine-Building Industry

A. Stages of Development

When the Communists came to power in 1949, China's machine-building industry consisted of a few pockets of activity in Shantung, Shanghai, Peking, and Tientsin. These production centers were heavily damaged by the Sino-Japanese War and the civil war that followed.

Moreover, the Japanese-built industrial base in Manchuria was nearly destroyed by the Soviets who removed more than half of the equipment during their brief occupation in 1945. By 1953, most machine-building facilities in China had been restored, but their primary function was to repair existing equipment and build simple machines.

1. SOVIET ASSISTANCE DURING THE 1950'S

The core of China's machine-building industry was formed through the massive material and technical assistance provided by the U.S.S.R. and East European countries that began in 1953. During the first 5-year-plan period (1953–57), out of the 166 major Soviet-aid projects in industry, nearly 100 were undertaken in the field of machine building. The U.S.S.R. supplied complete sets of equipment for plants making metallurgical and mining equipment, electric power machinery and equipment, transportation equipment, agricultural machinery, chemical industry equipment, and machine tools.

Many of the remaining projects supplied by the Soviets formed the basis of China's military machine-building industry. In this important category were plants to produce aircraft, naval vessels, electronic equipment, land armaments, and nuclear weapons. Additional agreements with the U.S.S.R. and East European countries in 1958–59, nearly doubled the number of modern industrial plants planned for the machine-building industry.

Orderly development of the machine-building industry became impossible after the Great Leap Forward was launched in 1958. This was an ill-conceived attempt to speed up industrial output by working men and machines at a furious pace. The policy of "walking on two legs"—based on the supposed existence of large unused quantity of labor and materials—encouraged the widespread construction of small, locally controlled, substandard plants. Decentralized planning and control of the small local plants, however, encouraged haphazard location and poor construction, shoddy production, and exaggerated output claims. A serious problem was that small plants diverted scarce raw materials from the modern industrial sector. With the collapse of the Great Leap, most of the local plants were either abandoned or shifted from manufacture of general industrial equipment to the production of agricultural machinery.

2. THE EARLY 1960'S

The machine-building industry retrenched with the rest of the economy from 1961–63. Production dropped sharply, capacity stood idle, and the regime pared down investment programs to a narrow range of essential industries. A new emphasis was given to the production of agricultural machinery, equipment for chemical fertilizer plants, and machinery for the petroleum industry. High priority, moreover, was assigned to the military machine-building sector, particularly to electronics and those industries involved in the development of atomic energy, missiles, aircraft, and naval ships. By 1966 the general status of the machine-building industry had improved, production was well above the 1957 level. General improvement can be attributed to increasing imports of machinery and technology from Japan and Western Europe.

3. THE CULTURAL REVOLUTION YEARS

Considerable dislocation in the machine-building industry occurred during the political turbulence of the Cultural Revolution (1966–69). Imports of equipment from the non-Communist world declined and technical exchanges were terminated. Although some components of the military machine-building industry were prohibited by official decree from engaging in factional disputes, production programs in other areas of machine building suffered enormously. The emphasis on factory level research allowed individual plants to improve their basic product design but prevented the industry from progressing smoothly toward the next generation of machinery products.

In spite of the disruptions of the Cultural Revolution, China achieved substantial increases in machine-building capacity during the late 1960's. Under the general slogan of "war preparation" the PRC engaged in a wide-ranging campaign to construct hundreds—and possibly thousands—of small-, medium-, and large-scale industrial projects throughout its remote interior regions. For example, construction of a major truck manufacturing complex began in the mid-1960's in a remote mountainous region northwest of Wuhan in Hupeh Province. This facility is reported to be the largest truck plant in China.

4. THE EARLY 1970'S

The scope of the overall construction program was enormous and continued into the early 1970's, after the Cultural Revolution had wound down. As part of the total construction effort, some existing industrial facilities were moved from border and coastal areas and new industrial complexes were started in places less vulnerable to foreign attack. Additional production capacity was achieved by completing construction of many industrial projects originally started under Soviet sponsorship. Major expansion of numerous key industrial facilities added significantly to the country's total machine-building capacity.

Reestablishing orderly economic planning, together with the additions to production capacity during the 1960's led to substantial increases in output during 1969–71. Production of military-related equipment reached peak levels, and electronics emerged as a favored sector among military-industrial planners. The small plant program, which had gained new respectability during the Cultural Revolution, reached boom proportions, while the construction of modern plants gained increased momentum. Self-reliance had become the watchword in the machine-building industry, and new products of indigenous design began to emerge at a growing rate.

Evidence of a major debate between military and civilian planners over machine-building priorities surfaced in mid-1971. The "electronics versus steel" controversy, which signaled the debate, was quickly followed by the Lin Piao affair. Following the death of Lin, production of military armaments plummeted sharply from the peak levels of 1970–71. The marching orders for the industry during the fourth 5-year plan (1971–75) included increased support to agriculture and the basic industries such as mining, petroleum, chemicals, and electric power. Increased emphasis also was given to purchasing large quantities of Western equipment and manufacturing technology.

B. Organization of the Industry

The first ministry of machine building has jurisdiction over most of the production facilities producing machinery and equipment for the civilian sector (see fig. 1). The broad responsibilities of this ministry include the research, design, and manufacturing of heavy machinery, machine tools, instruments and meters, agricultural machinery, construction machinery and mining equipment, motor vehicles and bearings, power generation machinery, and other electrical equipment.

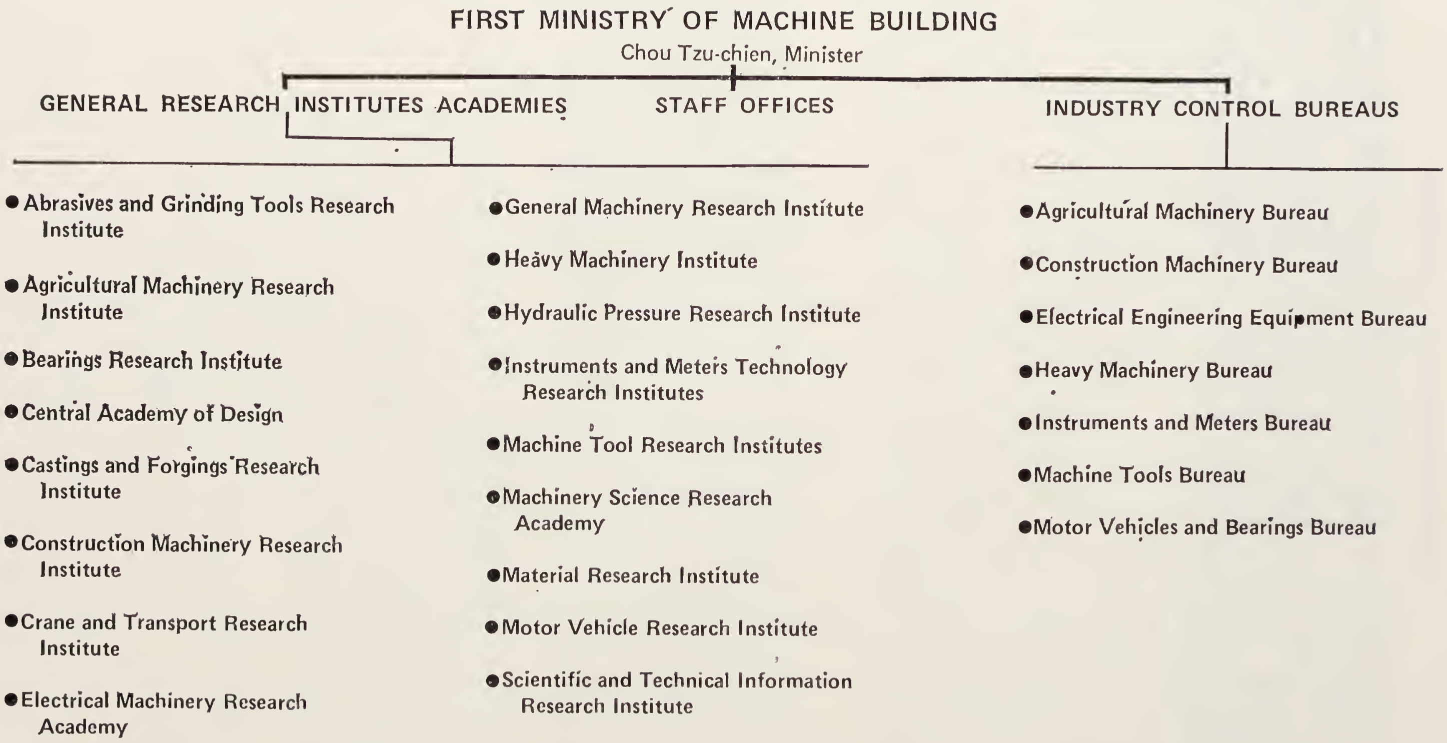
FIRST MINISTRY OF MACHINE BUILDING
Chou Tzu-chien, Minister
GENERAL RESEARCH INSTITUTES ACADEMIES
STAFF OFFICES
INDUSTRY CONTROL BUREAUS
Abrasives and Grinding Tools Research Institute
Agricultural Machinery Research Institute
Bearings Research Institute
Central Academy of Design
Castings and Forgings Research Institute
Construction Machinery Research Institute
Crane and Transport Research Institute
Electrical Machinery Research Academy
General Machinery Research Institute
Heavy Machinery Institute
Hydraulic Pressure Research Institute
Instruments and Meters Technology Research Institutes
Machine Tool Research Institutes
Machinery Science Research Academy
Material Research Institute
Motor Vehicle Research Institute
Scientific and Technical Information Research Institute
Agricultural Machinery Bureau
Construction Machinery Bureau
Electrical Engineering Equipment Bureau
Heavy Machinery Bureau
Instruments and Meters Bureau
Machine Tools Bureau
Motor Vehicles and Bearings Bureau

Figure 1

The second through seventh ministries of machine building are tasked respectively to develop and produce nuclear weapons, aircraft, electronics equipment, conventional armaments, ships, missiles and aerospace systems. The third (aircraft), fourth (electronics), and six (shipbuilding) ministries of machine building have the dual function of producing equipment and hardware for both civilian and military application.

The machine-building industry in China is made up of three types of enterprises. One group is controlled by the central government; a second group receives dual supervision from central and local authorities. China's large-scale, modern machine-building enterprises generally fall into the first category. These facilities represent the mainstay of the industry and encompass a substantial number of Soviet-sponsored projects. The second category of enterprises consists of a few large but mostly medium- and small-size facilities that are supervised jointly by central and local (provincial, prefectural, and county) authorities.

A third group of machine-building plants are under direct control of local authorities but act in accordance with broad outlines laid down by higher authorities. These collectively run enterprises are essentially small plants which are operated primarily for the benefit of the communes. Most of these facilities produce simple farm tools and basic farm machinery.

C. Production Claims and Estimates

The fragmentary data on output from the machine-building industry makes production estimates subject to a large margin of error. Published gross-value claims probably include military hardware as well as producer and consumer durables. The Chinese claimed in 1972 that the total output value of the machine-building industry in 1971 was 13 times that of 1957. Also in 1972, the Chinese stated "in the past two decades and more since liberation, the output of the machine-building industry has increased more than 20 percent every year on the average." Another semiofficial statement in mid-1977 noted "in the 27 years since the founding of the country, our machinery production had an average annual rate of growth of more than 20 percent."

Apart from the dearth of official production data, there is some question concerning the validity of the little information which is released. Statistical reporting by individual provinces and other administrative echelons came under strong attack by the post-Mao leadership during 1977. Charges of fabrication of provincial production data were levied against a number of key ranking officials who were later purged from office.[1]

Physical output statistics are available on only a few sectors of China's machine-building industry (see table 1). Of those commodities for which output estimates are available, the highest rate of growth during the last decade was shown by electric power generating equipment and agricultural tractors, industries basic to the development of

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[1] According to the PRC press, officials in Anhwei, Hopeh, Kansu, and Liaoning had been charged with, or had admitted to making, false industrial and agricultural claims. Based on the emphasis Peking has recently given to improving statistical work, the phenomenon is probably more widespread than the four Provinces would suggest.

China's entire economy (see table 2). From 1965 to 1976, their output increased at an average rate of about 20 percent per year. This is in marked contrast to the machine tool industry, where production grew at an estimated rate of only about 6 percent annually. The relatively slow growth in the machine tool industry can be partly explained by the changing mix of production. The Chinese have been attempting to upgrade the technological character of their machines from simple tools to advanced multipurpose machines. For example, China has begun limited production of numerically controlled machine tools; multiaxis tools, including numerically controlled two- and three-axis machines; and multispindle and multicutter machine tools, including two- and four-head models. The net effect of these changes represent an increase in capability without a commensurate increase in output.

TABLE 1.—ESTIMATED PRODUCTION OF SELECTED MACHINERY AND EQUIPMENT, 1949–76

	Power generation equipment (megawatts)	Power technology equipment (thousand horsepower)		Machine tools (units)	Spindles (thousands)	Sewing machines (thousands)	Powered irrigation equipment (thousand horsepower)	Agricultural tractors (standard units)		
		Internal combustion engines	Diesel engines					Total	Conventional	Garden
1949	10	4		1,582						
1950	23			3,312						
1951	32			5,853	132					
1952	30	28	18	13,734	383					
1953	60			20,502	287	257				
1954	55			15,901	489	316				
1955	108			13,708	304	174				
1956	288	541	371	25,928	784	206	170			
1957	312	609		28,297	484	278	52			
1958	1,425			30,000	1,000	637	720	1,100	1,100	
1959				35,000	1,360	563	1,255	9,400	9,400	
1960				40,000		676	1,610	23,800	23,800	
1961				30,000			700	16,200	16,200	
1962				25,000			955	13,100	13,100	
1963				35,000			640	15,700	15,700	
1964	625			40,000	700	1,257	607	19,450	19,300	150
1965	800			45,000	1,400	1,571	809	23,875	23,000	875
1966	1,000			50,000			1,079	34,625	32,000	2,625
1967	1,200,			40,000			1,161	29,100	27,000	2,100
1968	1,500			45,000				32,675	30,000	2,675
1969	1,800			55,000		1,800		43,200	40,000	3,200
1970	2,300			70,000		2,400		79,000	70,000	9,000
1971	2,900			75,000		3,000	2,644	114,625	105,000	9,625
1972	3,600			75,000		3,300	3,716	136,000	115,000	21,000
1973	4,300			80,000		3,894	5,986	166,000	138,000	28,000
1974	5,100			85,000			9,708	150,000	120,000	30,000
1975	6,000	31,000	16,000	90,000			11,370	180,000	140,000	40,000
1976	6,600			85,000				190,925	128,800	62,125

	Mainline locomotives (units)				Freight cars (units)	Merchant vessels (LSD tons)	Trucks (units)	Radio sets (thousands)	Television sets (thousands)
	Total	Steam	Diesel	Electric					
1949	----	----	----	----	3, 155	----	----	----	----
1950	----	----	----	----	696	----	----	----	----
1951	----	----	----	----	2, 882	----	----	----	----
1952	20	20	----	----	5, 792	6, 100	----	17	----
1953	10	10	----	----	4, 501	14, 800	----	25	----
1954	52	52	----	----	5, 446	31, 400	----	28	----
1955	98	98	----	----	9, 258	50, 200	----	151	----
1956	184	184	----	----	7, 122	51, 200	1, 654	270	----
1957	167	167	----	----	7, 300	46, 400	7, 500	390	----
1958	350	346	2	2	11, 000	61, 300	16, 000	1, 200	----
1959	533	530	3	----	17, 000	54, 300	19, 400	1, 560	----
1960	602	600	----	2	23, 000	23, 600	15, 000	1, 500	----
1961	100	100	----	----	3, 000	18, 800	1, 000	1, 250	2
1962	25	25	----	----	4, 000	13, 500	8, 400	1, 000	3
1963	27	25	----	2	5, 900	23, 400	16, 800	1, 000	3
1964	27	25	2	----	5, 700	31, 000	20, 300	1, 000	5
1965	50	20	30	----	6, 600	50, 600	30, 000	1, 500	5
1966	220	150	70	----	7, 500.	55, 900	43, 000	1, 500	8
1967	300	200	100	----	6, 900	48, 200	32, 000	1, 500	5
1968	340	200	140	----	8, 700	64, 500	27, 000	2, 000	5
1969	391	230	160	1	11, 000	93, 100	60, 000	2, 500	10
1970	435	250	180	5	12, 000	121, 500	70, 000	4, 600	15
1971	455	250	200	5	14, 000	148, 000	86, 000	6, 000	20
1972	475	250	220	5	15, 000	164, 600	100, 000	6, 700	40
1973	495	250	240	5	16, 000	209, 400	110, 000	12, 100	75
1974	505	250	250	5	16, 800	288, 400	121, 000	15, 000	115
1975	530	250	275	5	18, 500	313, 600	133, 000	18, 000	205
1976	530	250	275	5	19, 000	305, 000	135, 000	----	163

TABLE 2.—*Average annual rates of growth in output of selected machinery and equipment, 1965–76*

Machine tools	5. 9
Power generation equipment	21. 4
Motor vehicles (trucks)	14. 7
Locomotives	9. 5
Freight cars	10. 1
Shipbuilding	17. 8
Agricultural tractors	19. 6

Transportation equipment industries have grown at moderate rates, with railroad equipment increasing at about 10 percent, motor vehicles (trucks) at nearly 15 percent, and shipbuilding nearly 18 percent per year. A large portion of the increase in motor vehicle production derives from new, small assembly plants built in rural areas.

Output of the machine-building industry in 1976 was generally little higher, and in some cases lower, than in 1975, reflecting disruptions caused by economic problems and the conflict over political succession. Excess capacity in most machine-building sectors will accommodate further growth during the next several years. A decline in new plant investment in 1973–74, however, will constrain growth once the excess capacity is utilized.

In terms of product diversity, gross value of output, and production capacity, the machine-building industry easily outdistances such developing countries as Brazil, India, and South Korea—three other less-developed countries with growing manufacturing industries. Qualitatively, each of these three countries probably has an edge on China in one or more particular areas. India, for example, is pushing ahead in ultra-high-voltage technology for power generation and transmission. One plant in India, BHEL in Hyderabad, has entered into a technical collaboration with Kraftwerke Union (KWU) of West Germany to produce turbogenerators with capacities ranging from 200 megawatt to 1,000 megawatt. Motor vehicle production in Brazil registered 979,000 units in 1976 as opposed to China's output of about 135,000. Brazil, moreover, produces more than 20 basic types of car models in cooperation with Volkswagen, Ford, General Motors, Chrysler, FNM (Alfa-Romeo), Mercedes-Benz, and Saab-Scandia. South Korea has built several 260,000 deadweight ton tankers; the largest tanker yet produced in China is a single 50,000 deadweight ton vessel that was launched in early 1977.

D. Technological Capabilities and Limitations

Technical capabilities in the Chinese machine-building industry, although much advanced since the Communist takeover, are still far below the level of industrialized nations and vary widely from industry to industry. In general, the basic technological capabilities in the machine-building industry stem from the massive transfer of technology and equipment from the U.S.S.R. in the first decade of Communist rule.

Product designs continue to reflect heavy Soviet and East European influence. In the agricultural sector, for example, Vice Premier Yu Chiu-li noted in early 1978 that China now manufactures mostly old "1940" or "1950" model tractors which are characterized by heavy frames, high fuel consumption, and low efficiency. In the transportation area, China is forced to rely on the "Liberation" brand cargo trucks, which include a basic 4-ton, general-purpose model copied from the old Soviet ZIL 150 and 157 equipment. In the machine tool field, the most common equipment produced is the C–620 lathe which also is of early Soviet design. The largest bulldozer serially produced in China, a 12-ton, 160-horsepower model, is similar to the Caterpillar D–6 of 1945 vintage. A tunnel boring machine which was recently trial manufactured for the mining industry is similar to equipment used in the West during the 1940's. Metallurgical equipment is mostly 1950 vintage technology as is a large part of the electric power generation and transmission equipment currently being produced in China. Even the highly publicized electronics industry in China lags considerably behind Western levels. According to comments made in November 1977 by Wang Cheng, head of the Fourth Ministry of Machine Building, the electronics industry continues to be backward and is unable to meet the needs of national defense and economic construction.

After the withdrawal of Soviet technical assistance, the Chinese benefited from the exploitation of Western technology through imports of complete plants and equipment, the culling of Western literature, admission of foreign technicians, and the sending abroad of trainees. The most effective means of acquiring Western technology has been through imports of machinery and equipment (see table 3). The first major effort to import Western equipment began in the mid-1960's, in the relatively quiet years between the Leap Forward and the Cultural Revolution. Purchases during this period were directed to carefully selected targets in the military-machine building area and other key industrial sectors. The electronics industry in particular was a major benefactor of Western technology in the form of complete plants for producing semiconductors, specialized instruments and measuring devices, and fabricated equipment including radar, telecommunications gear, navigation aids, and similar electronic systems.

TABLE 3.—SELECTED CHINESE EQUIPMENT IMPORTS FROM NONCOMMUNIST COUNTRIES

[In thousand U.S. dollars]

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Metalworking machinery [1]	17, 291	31, 847	51, 790	30, 265	23, 523	46, 555	62, 598	22, 699	19, 627	51, 662	110, 235	275, 688
Power technology equipment:												
Engines, generation equipment	3, 952	14, 913	9, 209	2, 875	4, 752	5, 018	9, 467	25, 310	31, 914	68, 739	102, 140	117, 251
Distribution equipment	6, 348	3, 595	7, 376	3, 649	3, 285	4, 208	4, 845	6, 010	13, 395	32, 936	91, 636	84, 695
Transportation equipment:												
Motor vehicles	10, 977	31, 373	20, 579	12, 434	13, 079	65, 964	88, 308	31, 703	59, 202	187, 980	156, 539	58, 461
Railroad equipment	793	3, 467	997	1, 959	4, 928	9, 588	2, 715	44, 022	30, 668	31, 402	8, 620	3, 341
Marine vessels	4, 397	15, 368	20, 741	2, 923	851	14, 720	4, 869	21, 281	81, 399	279, 036	317, 036	43, 210
Construction, mining, materials handling	17, 196	15, 797	10, 492	3, 564	4, 171	17, 421	23, 513	16, 342	17, 065	87, 329	82, 739	45, 310
Agricultural equipment	11, 971	2, 362	262	46	1, 413	2, 514	1, 117	5, 246	843	29, 054	14, 674	211
Electronics/telecommunications	38, 935	44, 001	32, 901	20, 967	17, 380	17, 256	8, 937	18, 205	32, 016	64, 825	17, 361	14, 821
Special industrial machinery	10, 622	15, 433	5, 723	3, 267	2, 904	1, 677	802	1, 938	13, 874	29, 014	34, 230	41, 333
General industrial machinery	10, 698	12, 590	16, 514	15, 323	19, 274	33, 340	39, 790	25, 200	49, 477	90, 477	16, 674	110, 119
Total	133, 180	190, 746	176, 584	97, 272	95, 563	218, 261	246, 961	217, 956	349, 480	952, 454	952, 884	794, 440

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[1] Includes machine tools and metallurgical equipment.

China's second major effort to acquire Western technology and equipment occurred during the first half of the 1970's. Between 1972 and 1976 Peking signed contracts with Western firms for almost $3 billion worth of complete industrial plants, mainly for the petrochemical, fertilizer, steel, and electric power industries (see table 4). Other important purchases during the period included technology intensive items such as semiconductor fabrication equipment, telecommunications systems, computers, and test and measuring devices. Of direct military significance was a $200 million contract with Rolls Royce for the technology and equipment to produce Spey aircraft engines.

TABLE 4.—CHINA: PLANT PURCHASES FROM JAPAN AND WESTERN EUROPE, BY TYPE

[In million U.S. dollars]

	1972	1973	1974	1975	1976	1977	1972–77
Total	58	1,265	851	409	159	62	2,804
Petrochemical	0	697	99	166	91	61	1,114
Metallurgical	0	0	554	10	57	0	621
Ammonia-urea	0	393	120	0	0	0	513
Electric power	23	163	58	3	0	0	247
Other	35	13	20	233	11	1	313

Even with the infusion of large doses of Western equipment and technology, China's machine-building industry labored under severe problems during much of the 1970's. A root cause was political factionalism related to the succession struggle. The authority of plant managers was eroded during each successive political campaign, with the result that labor discipline declined. Factionalism led to massive slowdowns in production at many plants, frequently culminating in complete work stoppages. Production at the Kiangsi Tractor Plant, for example, plummeted from about 5,500 tractors in 1973 to 1,500 units in 1976. At the same time, output at the giant Loyang Tractor Plant was reported to have reached only one-fourth of the planned 1976 target. These and many other plants operated under the principle of "keeping politics in command" with emphasis on mass movements, cadre participation in labor, and worker participation in management. The net result of the chaos was poor quality output, high production costs, excessive consumption of raw materials, and high accident rates.

E. Planned Reforms

The question of centralizing control over machine-building facilities has become an issue of increasing concern to the post-Mao leadership. A decade of near autonomous control over production at various administrative levels has eroded Peking's authority to allocate resources and plan production. Of particular concern to state planners has been the diversion of scarce resources away from large, centrally controlled plants to the local levels.

An important first step toward strengthening central control was outlined in Yu Chiu-li's January 1978 announcement of sweeping reforms to reorganize small-scale industry. Under Yu's broad-ranging proposals, new emphasis will be placed on specialization, standardization, and serial production in the machine-building industry, starting with agricultural machinery and equipment. Yu outlined an ambitious

3-year program to convert most small- and medium-sized plants from general equipment producers to producers of specialized components under contract to large plants. The large plants in turn are expected to standardize their product and produce only equipment that is practical and of high quality.

Yu went on to add that it is only through economies of scale that China would be able to employ assembly line production techniques. A system of technologically advanced large-scale plants is to become the cornerstone of China's new policy to establish six semi-independent economic regions. Along this line, Yu described how local authorities in Chang-chou, by combining individual gearmaking equipment from seven tractor plants into one large plant and by adopting more specialized techniques, were able to double the rate of gear production in 6 months. The concept of small plants supporting and then developing into large plants is reminiscent of the practice adopted by Japan during its early development stages and could have a marked impact on China's overall industrial development.

A new phase of technology acquisition through complete plant and equipment purchases is clearly in the offing and could eclipse all previous import programs. Extensive negotiations have been underway during the past year with Western firms for additional plants and equipment. In particular, the Chinese are interested in complete plants to supplement and modernize their fertilizer, metallurgical, petrochemical, electronic, transportation, construction, and mining industries. Imports of specialized equipment will cover a broad range of technologies from general purpose machinery to highly specialized electronic devices and equipment.

A high proportion of modern technologies and equipment are likely to come from Japan as part of the unprecedented 8-year, $20 billion trade pact signed between the two countries in February 1978. Under the terms of the agreement, China is to receive $7 billion to $8 billion in complete plants and around $2 billion to $3 billion in construction materials and equipment.

F. Pitfalls to Progress

China's new program to rationalize and modernize its machine-building industry will not come easy. The recent emphasis on discipline and stronger management could encounter severe resistance from a labor force accustomed to a leisurely work pace. Moreover, Yu Chiu-li's plan to completely reorganize the farm machinery industry within 3 short years seems unrealistic. The proposal comes at a time when Peking is having trouble locating competent middle-level managers for all sectors of industry. The country also lacks the transportation and distribution systems necessary to rapidly put the plan into effect along the lines Yu envisions.

At the same time, China's ability to fully use, copy, or improve on large-scale purchases of advanced technology and equipment assigned to the machine-building industry is seriously hindered. A major gap in basic research skills, manufacturing know-how, and poor organization and communication channels argues against China's rapid assimilation of Western technology. A decade without advanced academic training for an entire generation has created a serious void in China's scientific and technical communities.

III. Subsectors of the Machine-Building Industry

A. Machine Tools

The machine tool industry provides the bulk of the capital equipment required for every component of the machine-building sector, including the machine tool industry itself. During the past 25 years, China's machine tool industry has sharply raised the level of output, from 1,600 to 90,000 machine tools annually. China has managed to assimilate Western and Soviet technology of the forties and fifties in its current serial production items but has had limited success in absorbing newer technologies, such as multiaxis and numerically controlled machining. While the PRC is basically capable of meeting current needs for general purpose machine tools, the low quality of raw materials, lack of coordination in research, and poor quality control inhibit the development of a solid domestic production base for the specialized and precision machine tools needed by industry and the military.

1. PRODUCTION CENTERS AND MAJOR PRODUCTS

China now has about 30 major machine tool plants and 150–200 minor plants of varying size. Despite attempts to develop industry in outlying areas, machine tool production remains concentrated in the East, North, and Northeast, with many of the larger plants located in Peking and Shanghai. Shen-yang, Harbin, Chi-chi-ha-erh and Tientsin are also major machine tool production centers. While many plants specialize in a particular type of machine tool, most produce a variety of equipment. China produces most major types of metal-cutting and metalforming tools, including lathes, boring machines, grinders, milling machines, shapers, gear cutters, thread-cutting machines, hydraulic presses, broaching machines, and planers.

2. DEVELOPMENT OF THE INDUSTRY

Soviet aid during the 1950's enabled the Chinese to build or expand over 20 major machine tool plants, including a number of war-damaged plants in the North and Northeast. The first stage was the development of domestic production of simple, general-purpose machine tools suitable for a wide variety of machining needs in the fabrication of agricultural, industrial, and transport equipment. Specialized and precision machine tools beyond Chinese manufacturing capabilities were provided by the U.S.S.R. Machine tool production increased from 1,600 units in 1949 to about 26,000 units in 1957. Orderly development under Soviet tutelage was followed by the frenetic "Leap Forward" years (1958–1960), when increased output was emphasized at the expense of quality and the maintenance of capital plant. In efforts to expand and spread out production, the small backyard shops came in vogue and old model lines were ressurrected, including primitive lathes that would not be classified as machine tools elsewhere. The withdrawal of Soviet assistance in 1960 left several major machine tool plants incomplete and eliminated China's prime source of supply for modern machinery.

Rebuilding efforts in the 1960's were focused on two problems: completion of the plants left unfinished by the Soviets and development of a diverse domestic production base. Specialized precision machine tools were needed in weapons development and for other strategic industrial purposes. Efforts to satisfy these needs were hampered by shortages of quality steels, low machine operator skills, and the varying quality of the existing machine tool base. Stopgap methods and procedures were used to provide partial solutions to China's most pressing machine tool needs, typified by the slogan of "ants gnawing on a bone" whereby small general purpose machine tools were employed to perform the function of larger, more sophisticated equipment.

In the 1960's, China turned increasingly to West European and Japanese suppliers to meet the need for specialized high-quality machine tools and for technology in their manufacture. At the same time, the Chinese extended plant construction efforts, establishing new small plants in outlying areas while expanding the existing major plants. The PRC probably will step up its imports of Western machine tools and production technology.

3. TECHNOLOGY

Machine tool technology in the PRC suffers from a double lag relative to foreign technology. Chinese laboratory accomplishments, being imitative, tend to run several years behind the Western state-of-the-art and the transition from trial production to serial production takes even longer, when it takes place at all. As a result, the technological level of factory produced machine tools lags as much as 20 years behind similar production in the West. For example, the most common machine tool produced in China is the C620 lathe. The C620, which is a copy of a Soviet design, has been produced since 1959. Primarily an engine lathe, the C620 and its variants are suitable for a wide range of machining needs.

Among the steps taken so far in machine tool technology: China has begun limited production of numerically controlled machine tools, multiaxis tools, including numerically controlled two- and three-axis machines, and multispindle and multicutter machine tools, including two- and four-head models. Production of such equipment continues to be low however, often single laboratory prototypes or small-batch factory production. In comparison, Western six-axis machines and eight-head machine tools are produced in quantity.

Machine tool development in China is hampered by several factors: the derivative rather than innovative character of research; the apparent lack of coordination in research; the gap between laboratory and factory capabilities; and factory inefficiency, including underutilization of capacity, poor working conditions, and lack of attention to inventory control. Plant organization in China is a particularly weak area; factories are vertically integrated, producing many or most of their own parts, and are unable to capitalize on the efficiency of specialization.

Despite these problems, Chinese are making progress in the machine tool industry, and have developed an export market for several basic machine tools. Some have been purchased by Western firms, usually because of price. An exhibit of PRC machine tools available for export, shown in Hong Kong in 1977, included gear-shaping machines, cylindrical grinders, optical profile grinders, lathes, and gear-grinding machines.

4. ESTIMATED OUTLOOK

Estimates of machine tool production must be pieced together from a few bits of official data. Government reports of plant performance usually give percentage increases in production rather than actual output figures. The problem is further complicated by the diverse product mix of some Chinese factories, which may turn out a miscellany of machine tools and other items. For example, plants that produce specialized machinery occasionally produce general-purpose machine tools for their own use.

B. Power Machinery and Equipment

The power machinery and equipment industry in China is made up of a wide range of facilities, from small local plants producing simple one-cylinder internal combustion engines to major industrial complexes capable of turning out larger turbine-generator sets. From its meager beginnings, the industry has progressed steadily both in capacity and equipment development.

1. INTERNAL COMBUSTION ENGINE

China's internal combustion engine industry, which consisted of only a few small plants in 1949, was built up during the 1950's with technology and equipment obtained from the U.S.S.R. and Eastern Europe. The abrupt termination of Soviet assistance in 1960 left the industry completely on its own, producing engines almost exclusively of Soviet and East European design. Considerable progress has been made over the past decade in redesigning China's basic product line through local innovation and adaption of Western technology. The process of change has been slow, owing to the emphasis on producing equipment that is simple to operate and service. While greater emphasis is currently being placed on quality as well as quantity, technological improvements are likely to be limited to such areas as reduced weight, increased power output, and greater fuel economy of small- and medium-size engines. Production of high-speed, high-horsepower engines in China remains limited, although some noteworthy developments have been made in supercharged engines.

A potpourri of production claims by provinces and individual plants suggests that internal combustion engine output in 1975 was slightly more than 31,000,000 horsepower. Diesel engine production during the year accounted for about 16,000,000 horsepower and gasoline engine production slightly more than 15,000,000 horsepower. Because of their versatility and widespread application as stationary and motive power sources, as well as low fuel costs, diesel engines are produced in far greater quantities, in terms of unit output, than gasoline engines.

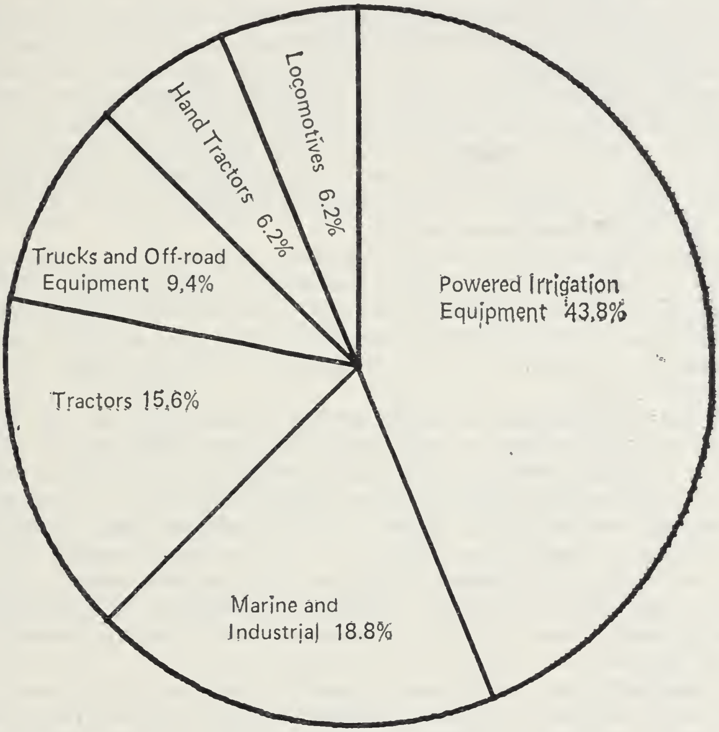
Diesel engines are produced in more than 125 different plants throughout China, from small local facilities producing simple 1-cylinder, water-cooled engines to large integrated plants such as the Hu-tung Shipyard in Shanghai which manufactures 12,000 horsepower engines for marine application.

Although efforts have been underway since 1958 to standardize diesel engine manufacture, nearly 100 different engine models and assorted variants are being serially produced. Gasoline engines are produced at about 15 different plants and are used mainly as the power source for trucks, automobiles, and selected types of equipment.

A standardized system of nomenclature and classification has evolved to identify two general classes of low- and high-speed engines with the division being at 750 revolutions per minute. Most serially produced engines are assigned a model designator that gives the number of cylinders and cylinder diameter; a model 6135 engine thus denotes a 6-cylinder engine with a 135 millimeter bore. Efforts are being made to limit the bore diameters of diesel engine cylinders to 20 to 25 sizes, thus improving the exchangeability and scale of production of pistons, piston rings, and cylinder liners—the parts requiring most frequent replacement.

As shown in the figure, diesel engines produced in China have wide application as stationary and motive power sources for a variety of equipment. About 44 percent of China's diesel engine output by horsepower is used to power irrigation equipment. Many of these engines are small, water-cooled, single-cylinder models which are mass produced in both large and small plants throughout China. Diesel engine models 195 and 1105, for example, are manufactured in at least 25 different plants. They are used in garden tractors as well as irrigation equipment and have been recently modified to increase the rated power output.

China: Estimated Diesel Engine Output
1976



16 Million Horsepower

FIGURE 2

Diesel engines produced for marine and industrial application are among the largest engines manufactured in China. The 18,000 horsepower model 6ESDZ 93/165 engine is the single biggest unit yet produced. This 6-cylinder, 930 millimeter base, 1650 millimeter piston stroke diesel was assembled at the Hung-chi shipyard (Talien) in early 1976 and will probably be used in a 50-000-ton oil tanker similar to the "Hsi-hu" which was launched from the yard in mid-1976. Marine diesels in the 10,000 to 20,000 horsepower range are produced in limited quantities at the Hu-tung Shipyard in Shanghai and at the Shanghai and Canton diesel engine plants. Engines of this size, which include models 6EDZ 43/S21, 6 ESDZ 76/100, and 6 ESDZ 75/160, are based largely on the Burmeister and Wain (Denmark) design. Many of the characteristics common to the Sulzer (Switzerland) diesel engine also are incorporated in Chinese models. As many as 15 different plants in China are capable of producing engines in the 650-horsepower range, including diesel engine plants in Shanghai, Canton, Wu-hsi, Wei-fang, and Ning-po. While many of these units are probably designed for marine use, they have equal application in power generation equipment, oilfield drilling machinery, switching locomotives, and off-highway trucks.

Nearly one-third of the diesel engine output, by horsepower, goes to plants making tractors, trucks, and off-road equipment. The types of diesel engines made available range from a 5 horsepower model for hand tractor application to a 400 horsepower unit in a 32-ton heavy-duty truck. Diesel engines in the 5 to 12 horsepower range are commonly used in hand tractors; those in the 20 to 80 horsepower range are used in medium and large tractors including crawler type tractors. Engines in the 90 to 400 horsepower range are used in truck and off-road equipment. China produces about 10 different types of engines in the 90 to 400 horsepower range.

Another important use of diesel power in China is in railroad locomotives. Total horsepower output for locomotives in 1975 is believed to have been around 1 million horsepower. Of this total, approximately two-thirds, or about 650,000 horsepower, was used as power sources for mainline locomotives, the remainder for mining and shunting locomotives.

The major producer of diesel engine locomotives is the Dairen locomotive plant which manufactures the Eastwind–2 and the Eastwind–4, 2,000-horsepower and 4,000-horsepower engines having 10 and 16 cylinders respectively. Other major producers of diesel engine locomotives are located at Tsing-tao, Chi-shu-yen, and Chang-hsin-tien. Plants in these cities produced diesel engines ranging between 1,500 and 3,000 horsepower. The Lo-yang locomotive and railroad rolling stock plant is one of a number of facilities in China manufacturing small locomotives with power sources ranging from 160 to 400 horsepower.

Gasoline engines, which are primarily used in trucks, cars, and jeeps, are produced at about 15 different plants throughout China. Major producers are integrated facilities that manufacture both trucks and engines, such as the Chang-chun No. 1 Motor Vehicle Plant, the Nan-ching Motor Vehicle Plant, and the Kuang-chou Motor Vehicle Plant. Gasoline engines for trucks are also produced at specialized engine plants including those located in Peking, Tientsin, Shang-hai, and Wu-han. The Peking Internal Combustion Engine Plant is one of China's major producers of gasoline engines for trucks, minibuses, and jeeps; it limits output to only one type, a 75-horsepower model equipped with an aluminum block and head. Several plants in Shanhai as well as in Hupeh and Kiangsu provinces produced numerous small gasoline engines of the 165 series.

A lack of modern technology and advanced production equipment hold back the manufacture of improved internal combustion engines. Engines produced in the People's Republic of China continue to be excessively heavy and consume considerable fuel. China suffers serious shortages of both high-powered and low-powered engines. Engine research and development appears to be conducted at the production facilities with little apparent input from design institutes or related research centers. Trial manufacture of a new engine at the factory level often causes a major decrease in the plant's output.

2. POWER GENERATION EQUIPMENT

Notwithstanding praise in the press for its rapid growth and development of new products, China's electric power equipment industry is probably one of the most technologically deficient sectors in machine building. Roughly one-third of the equipment produced each year is believed to be used for replacing damaged or obsolete units. Key officials in the electric power industry currently term this industrial branch the "weak link" in the national economy. Inadequate machine tools, shoddy production practices, and poor operating and maintenance procedures of the finished equipment have contributed to lackluster performance.

Expansion of manufacturing capacity of electric power equipment has been a major goal in China's industrialization program. The manufacturing base was expanded considerably during the first 10 years of Communist leadership with aid from the U.S.S.R. and Eastern Europe. The withdrawal of Soviet aid in 1960 brought expansion to a halt; it was not resumed on a large scale until late 1969, when the Cultural Revolution tapered off. Modernization and expansion in the 1970's has added substantial new capacity. In addition, numerous medium- and small-scale facilities have been expanded or newly constructed as part of China's decentralization program. China's 1976 output of electric power equipment was about 6,600 megawatts or slightly more than the 6,500 megawatts of turbine generator equipment produced in Italy during the same period.

The major centers of electric power equipment production are Harbin, Shanghai, Te-yang, and Peking. Facilities producing electric power generator equipment in the 15–75-megawatt range are located in Nan-ping, Nan-chang, Hang-chou, Wu-han, and Tientsin. The Harbin electric power equipment complex, one of the largest in China, is a leader in hydroelectric equipment production as well as a major producer of thermal power equipment. The complex includes the Harbin boiler plant, turbine plant, and electrical machinery plant. Together these facilities contribute to the production of 2,000 megawatts of electric power equipment per year. Equipment produced includes thermal units with capacities up to 200 megawatts and hydrogenerators as large as 300 megawatts. The Harbin plants produced China's first 100-megawatt hydroturbine generator in 1963, a 225-megawatt hydrogenerator in 1969, and a 300-megawatt hydro unit in 1973.

The Shanghai electric power equipment center at Min-hang is China's leading producer and major developer of thermal power generation equipment. Major facilities at this center include the Shanghai boiler plant, steam turbine plant, and electrical machinery plant. Annual production at the Shanghai center matches the 2,000 megawatts of equipment produced at Harbin. Output of thermal power equipment has included China's first 50-megawatt steam turbogenerator in 1958, a 100-megawatt unit in 1960, a 125-megawatt unit in 1969, and a 300-megawatt steam turbogenerator unit in 1971. The Shanghai complex will likely be the first to produce a unit larger than 300 megawatts, possibly a steam turbogenerator in the 500–600-megawatt range.

China's newest and possibly largest power equipment production center is the Te-yang complex located in Szechwan Province. Facilities at this complex include a boiler plant in Tzu-kung, a steam turbine plant in Mien-chu, and an electrical machinery plant in Te-yang. Although, the complex has only been in operation since the early 1970's, a March 1976 NCNA broadcast indicates that it had already provided sets of equipment for more than 20 large and medium thermal and hydroelectric powerplants. The complex can turn out steam turbogenerator sets as large as 200 megawatts and hydroelectric generators of 210 megawatts. While a few Chinese claims have been made on the production capacity of the Te-yang complex, current output of power generation equipment is believed to be in excess of 1,000 megawatts.

Until late 1969, the Peking power equipment industry comprised a number of medium and large-scale factories which operated relatively independently of one another. An effort was made to integrate some of the larger plants into a combined enterprise for the production of complete sets of equipment. The amalgamation of the Peking Heavy Machinery Plant, the Peking Boiler Plant, and the Peking No. 2 General Machinery Plant, and the Peking Electric Machinery Plant is claimed to have resulted in a major increase in production, with total annual output now in excess of 600 megawatts. The equipment produced at the Peking complex is 100 megawatt or less in size, much smaller than the units manufactured in China's other leading centers.

In addition to the major production centers, small centers contribute to China's electric power-generating capacity. The Tientsin Generating Equipment Factory is a key producer of hydro turbogenerators ranging in size from 3.2 megawatts to 80 megawatts. The plant produces Kaplan, Francis, and Pelton type hydroelectric turbines and has an annual output of about 300 megawatts. The Wu-han Stream Turbine Plant is another large producer and in 1975 manufactured its first 50-megawatt steam turbogenerator. A 50-megawatt steam turbogenerator was also produced at the Hangchow Turbine Plant. Collectively, these facilities and smaller production plants throughout China add as much as 1,000 megawatts of electric power generation equipment to China's total annual output.

China's production of electric power generation equipment has progressed steadily over the years but at a decreasing rate. Total production in 1976 was believed to be 6,600 megawatts, more than eight times the 1965 output of 800 MW. The most recent Chinese claims indicate that the 1975 output of power generation equipment was only 7.5 times the 1965 output, or about 6,000 MW. While these figures show a definite gain in annual output, the rate of growth has slowed noticeably. In 1965–71, when new plants came into operation and emphasis was on manufacturing small-size units, the annual rate of growth in electric power equipment was about 24 percent. In 1972–75, the average rate of growth slowed to 20 percent, even though the Te-yang facility came on stream.

There is a disparity between the production of electric power generation equipment and the annual increases in installed capacity. Production of power generation equipment for the 5-year period 1972–76 was 25,600 MW. The increase in installed power generating capacity for the same period has been estimated to be 16,300 MW, including foreign and domestic equipment. While it is possible that some discrepancies exist in the production estimate, a large share of the electric power equipment produced each year—apart from that which is exported—probably is used to replace inferior and obsolete equipment installed in China's thermal and hydroelectric power generating plants. Exports of small units—mainly to customers in Asia—take a minor portion of output.

3. POWER TRANSMISSION AND DISTRIBUTION EQUIPMENT

China's power transmission and distribution equipment industry comprises a broad spectrum of manufacture, including transformers, insulators, high and low voltage switches, circuit breakers, wire and cable, and a variety of control and communications equipment. Starting from a small manufacturing base developed largely through Soviet and East European assistance, China has transformed the industry into a widely dispersed operation comprising both locally controlled plants and large industrial centers. The level of technology continues to lag, perhaps 10 to 20 years behind that of the industrialized West. While product improvements within the industry have managed to keep pace with China's rudimentary power transmission and distribution requirements, long-term plans for constructing large hydroelectric power plants and expanding existing facilities will find the industry hard pressed to move large power blocks from the generating source to the user.

4. TRANSFORMERS

China's power transformer industry has been a rapidly developing sector in the transmission and distribution field. Until 1960, the largest transformers produced in China were 60-MVA three-phase and 40-MVA single-phase units. By 1965, China had trial-produced its first 240-MVA transformer. China is presently capable of serially producing 250-MVA units and has produced a limited number of 300-, 330-, and 360-MVA transformers. China will probably trial-produce a 660-MVA unit soon and then concentrate on developing units of 1,000 MVA and over.

More than 30 plants in China manufacture transformers. Most are small- and medium-scale plants which produce low capacity units for rural application, mines and industrial use. The largest transformer manufacturing facilities are located in Shen-yang, Sian, Shanghai, and Peking. The Shen-yang Transformer Plant is the largest transformer development and manufacturing center in China. It produces more than 650 different kinds of transformers in sizes ranging from 11 MVA to 360 MVA. Formerly built by Japanese occupation forces, output at the plant has increased from about 100 units in 1950 to approximately 20,000 units in 1976. The largest transformers produced at the plant weight over 200 tons.

5. SWITCHING EQUIPMENT

Products of the electrical switchgear industry in China include such items as switches, relays, fuses, panel boards, distribution boards, and circuit breakers. Manufacture of this equipment is collectively referred to as the high-tension electric apparatus industry with major plants classified as low-voltage or high-voltage equipment producers. The classification of products as low voltage equipment generally indicates less than 500 volts. The major centers for producing high and low voltage switches in China are located in Canton, Peking, Shanghai, Shen-yang, and Sian. A number of other facilities scattered throughout the country are mostly small- and medium-size plants producing for local consumption.

6. CIRCUIT BREAKERS

China manufacturers both air-break and oil-break type circuit breakers. The largest serially produced circuit breakers are minimum oil type with 220–kv, 1,000–A, 700–MVA ratings for outdoor use. Air-blast breakers with interrupting capacities of 15,000 MVA at 330 kV have been manufactured for the single 330-kV transmission line. Other minimum oil type circuit breakers in use include 10-kV, 600-A continuous 200 MVA interrupting, indoor; 10-kV, 1,000-A continuous 500 MVA interrupting indoor: 35 kV, 1,000-A continuous 100 MVA interrupting, outdoor; and 110-kV, 1,000-A continuous 3,500-MVA interrupting, outdoor. A range of switchgear up to and including 220-kV equipment is manufactured for use in power station switchhouses and switching substations. While some progress has been made in extending the rated voltage of high-tension electric apparatus in China, the equipment produced is based almost entirely on Soviet and East European design.

7. INSULATORS

The high-voltage porcelain insulator branch produces a variety of equipment including disk-type suspension insulators, pin-type insulators, insulators for crossarms, solid core strut insulators for high-tension lines, porcelain bushings, and capacitor-type bushings for power stations. The major producers of high voltage porcelain insulators are the Sian High Voltage Insulator Plant and facilities located in Fu-shun and Ta-lien. Smaller electrical porcelain plants are located throughout.

The industry relies heavily on early Soviet design technology. Quality of output is generally less than desired. The insulating capacity of equipment currently produced is limited mainly to 220 kV, although some 330-kV insulators have been produced at the Sian plant. As the demand for higher transmission voltages increases, and the need for insulators of larger size and greater strength becomes necessary, China will be faced with the problem of acquiring production equipment technology from abroad.

8. WIRE AND CABLE

Wire and cable for China's power transmission system are produced at more than 20 plants scattered throughout the country. The major manufacturing centers are located in Shen-yang, Shanghai, Sian, Canton, Kun-ming, and Tientsin. The Shen-yang Cable Factory produces all types of electric wires and heavy cable, ranging from 0.01-mm diameter copper wire, to large, lead-coated aluminum cables of 220 kV, and aluminum-wrapped steel cable of 330 kV. The 330-kV cable, the largest yet produced in China, was trial-produced at the Shenyang plant in 1969 and later used on the Lanchou- Pao-chi 330-kV lines which became operational in 1975. Another major manufacturer of electric power cable is the Shanghai Cable Plant which has become a major producer of oil-filled electric power cable for underwater transmission. The plant successfully manufactured China's first 110-kV underwater oil-filled cable in 1968 and has subsequently manufactured a 220-kV cable and trial-produced a 330-kV underwater cable. The use of aluminum in wires and cables has been expedited as a national policy, aluminum being cheaper and more readily available than copper.

C. Transportation Equipment

Production of transportation equipment—locomotives, freight cars, trucks, and merchant ships—is a major function of China's machine-building industry.

1. LOCOMOTIVES

Until 1965, China produced only steam locomotives and a few experimental diesel and electric models. Subsequently, Peking has emphasized diesel locomotives which are needed to operate throughout China's vast arid and mountainous regions.

Output of locomotives in 1976 was an estimated 530 units—275 diesels, 250 steam, and 5 electric. Diesel electric locomotives, primarily 4,000-hp units, are produced at Dairen; diesel hydraulic locomotives of up to 5,000 hp are manufactured at Tsing-tao; and 5,200-hp electric locomotives are produced at Chu-chou. All of the steam locomotives presently produced in China are manufactured at the Tatung Locomotive Works.

Chinese-made locomotives are basically copies of Soviet and West European models, modified for local conditions. The plants producing the diesel and electric locomotives were previously used to manufacture steam locomotives. Most of the equipment used to manufacture and assemble locomotives was either provided by the Soviets or replicated by the Chinese from foreign designs. Some Western equipment is now being imported to replace wornout or obsolete machinery.

China continues to improve and modify its diesel and electric locomotives. By 1980, the PRC probably will discontinue manufacture of steam locomotives and concentrate on producing more modern and efficient diesel and electric locomotives. In addition, China will explore other sources of locomotive power. A recent advancement, for example, has been the production of a prototype 4,000-hp gas turbine locomotive.

2. FREIGHT CARS

Almost 60 percent of China's estimated 1976 inventory of 251,000 freight cars were built since 1965. The newer cars, of modern design, have capacities of 50 to 65 tons. Most cars built before 1965 had capacities of 33 tons or less. Gondola and hopper cars make up the largest group of cars in the fleet; they can be used to haul a wide variety of commodities. Tank cars, accounting for a quarter of the fleet, are needed to haul China's increasing volume of petroleum products. The remainder are boxcars, flatcars, stock cars, and refrigerator cars.

Most production comes from three plants. Box and gondola cars are produced at Chi-chi-ha-erh; tank cars for petroleum products and chemicals as well as gondolas and hopper cars are made at Dairen; the balance of gondolas are manufactured at Chu-chou. The Chinese have standardized their car types and parts. This has improved efficiency of production and operation, and has simplified maintenance and repairs.

Production of freight cars of all types have averaged about 17,000 units a year in 1972–76. Imports of freight cars, which have consisted mainly of tank cars, continues to be negligible. About 160 freight cars were imported in 1976, all of them tank cars from Romania.

3. TRUCKS

The Chinese truck industry is backward both in models produced and production methods. Established in the mid-1950's with substantial Soviet assistance, the industry began production in 1956, turning out about 1,700 trucks. By 1976, annual production had reached 135,000 vehicles (not including jeeps, buses, or three-wheel trucks). Most of the trucks produced are general-purpose cargo vehicles which perform a wide range of transportation services. Specialized trucks used in mining, forestry, construction, and petroleum are also produced in limited numbers. Nearly half of truck output comes from the Soviet-designed Ch'ang-ch'un No. 1 Motor Vehicle Plant. Other major truck manufacturing plants are located at Tsinan, Shanghai, Nan-ching, and Canton. A growing number of trucks are being assembled in numerous small plants established at the Province level. Chassis, engines, and other subassemblies are supplied by the major plants.

Various models of the "Liberation" brand cargo trucks, are the most common vehicle. This is a basic 4-ton general purpose truck copied from the Soviet ZIL 150 and 157, models that the U.S.S.R. has not produced in years. The basic chassis and engines are adapted for tank trucks, cranes, and even firetrucks. The off-the-road "Liberation" model is equipped with all-wheel drive and a larger engine. Other vehicles include the 2½-ton "Leap Forward" truck copied from the Soviet GAZ 130 and 63, which is produced in Nan-ching; the 8-ton "Yellow River" diesel truck modeled after the Czech SKODA 70 GRT, which is produced in Tsinan; and special large off-the-road trucks of up to 32-ton capacity which are produced in Shanghai. The 32-ton truck has a 12-cylinder, 400-hp diesel engine.

The People's Republic has been importing a large number of modern trucks. Before 1966, the U.S.S.R. was the primary source, but by 1976 Japan, Romania, France, and Italy were supplying about 75 percent of the 11,700 imported trucks. Most imported vehicles are general-purpose trucks; the Chinese also have bought large off-the-road mining trucks, and special-purpose vehicles.

4. SHIPBUILDING

In recent years, China's shipbuilding capabilities have increased dramatically. Output rose from 73,100 dwt in 1965 to an estimated 560,000 dwt in 1976, although 1977 production seems to have been cut back sharply. Freighters and tankers of 10,000 to 24,000 dwt are typical of current PRC capabilities; China's first 50,000-ton tanker was launched in 1976 at Dairen.

Production of major vessels is centered at Shanghai (freighters) and Dairen (tankers), using locally supplied marine engines. Smaller centers at Canton and Tientsin build an occasional 10,000-ton ship and, together with hundreds of smaller yards spread along the coastline, provide China's needs for smaller ships and boats.

China's domestically produced merchant ships are generally assigned to PRC river and coastal fleets; the international fleet includes many larger ships bought secondhand. The Chinese apparently intend to take advantage of the current buyer's market existing worldwide for larger tankers and freighters and have assigned a low priority to further upgrading of domestic production.

D. Metallurgical Equipment

The development of China's metallurgical equipment industry has closely paralleled the nation's policy for shaping the technological structure of its iron and steel manufacturing. Initially China turned to the U.S.S.R. and East Europe for comprehensive technical assistance. These countries provided large-scale, modern equipment that compared favorably with the best available at the time. They also provided technical training and helped to build up China's domestic capability for manufacturing equipment for the iron and steel industry. China's dissatisfaction with the rate of growth of iron and steel production led to the introduction of small scale, and basically primitive equipment that could be built faster and cheaper than the Soviet equipment. The collapse of the Leap Forward and withdrawal of Soviet technicians in 1960 led to the eventual abandonment of small plant equipment manufacture and a significant cutback in production of equipment for large iron and steel plants.

By the mid-1960's, China had resumed the expansion of its iron and steel industry, except for a brief but sharp setback in 1967–68 during the Cultural Revolution. Self-reliance, however, had become the watchword in the metallurgical equipment industry, as in the rest of the economy. Imports of equipment and technology were reduced to the selective acquisition to the most advanced technology.

By the early 1970's, the PRC leadership recognized the growing imbalance within the iron and steel industry, the result of melding primitive and modern technologies. The stock of Soviet equipment was rapidly becoming obsolete and domestically produced equipment was primitive. As a first step in correcting this problem, China in 1974 purchased four major installations for the steel industry—a cold rolling mill and a continuous casting system from West Germany and a hot strip mill and a silicon sheet mill from Japan. While these purchases will significantly advance China's production of finished steel, other areas of the iron and steel process still require massive new investment.

1. IRON MAKING

China's metallurgical equipment industry produces standardized types of both modern and native blast furnaces for making pig iron. The predominant modern type is a Soviet-designed furnace. Automatic controls are used on some of the larger blast furnaces for charging raw materials, regulating temperatures and pressures, and tapping the liquid iron. Mechanization of the many medium and small blast furnaces throughout China has been slow, however, forcing the equipment to be operated below capacity.

Iron ore beneficiation equipment is manufactured at several major plants. A 700-ton sintering machine was reported to have been trial produced in 1970 at the Shen-yang Heavy Machinery Plant. Production of this sintering equipment suggests that China has not yet developed much pelletizing equipment—a more advanced method of agglomerating iron ore. Efforts have been made to increase the size of China's modern blast furnaces. In 1976 China announced that the Wuhan Steel Plant had the largest blast furnace in the country with a capacity in excess of 2,000 m^3. A larger furnace was put into operation at the Anshan Steel Works in early 1978, with a reported volume of 2,580 m^3 or the capacity to turn out 1.5 million tons of pig iron a year. The small native blast furnaces are found at local plants; they have annual capacities ranging from a few thousand tons to perhaps 10,000 or 20,000 tons. These are generally built from discarded equipment and employ few if any mechanized process.

2. STEEL MAKING

The equipment most common in China's steelmaking process is the open hearth furnace. A major effort has been made to expand the capacities of open hearth furnaces at a number of China's major steel plants. Progress also has been made in expanding the use of top blown converters for oxygen injection into the steelmaking furnace. While of lesser capacity than the open hearth furnaces used in China, the top blown converter cuts down the time needed to produce each heat of steel. The Chinese have also claimed success in using oxygen in the open hearth process, to produce high quality steel. Sideblown converters, which do not use the high quality oxygen required for the top blown process are becoming standard steelmaking equipment for local plants. The sideblown converter has quick start-up time and is relatively inexpensive.

Other steelmaking equipment produced in China includes non-vacuum-electric furnaces, vacuum-arc refining furnaces, and possibly a small number of electron beam furnaces. The Chinese recently claimed success in developing a smoke exhaust device for electric furnaces which eliminates these particles without affecting the quality of steel.

3. STEEL FINISHING

The metallurgical equipment industry manufactures a broad array of steel shaping equipment. Finishing mills include large blooming and rail structural mills and small- to medium-sized rod and bar, plate, sheet, and both welded and seamless tube mills. Since the early 1970's, China has claimed considerable success in improving its continuous casting techniques. A curved-type continuous casting machine has been developed as well as a planetary rolling mill which can be used with a continuous casting machine. Other types of rolling mill equipment produced by the metallurgical equipment industry include a 1,700-millimeter continuous hot sheet mill, a 1,150-millimeter cold strip mill, a 4,200-millimeter plate mill, and a 700-millimeter 20-roll, fine Sendzimer-type sheet mill. While these claims suggest that the level of China's domestic production capability is improving, imports of similar equipment from Japan and West Germany underscores the nation's need for additional and better quality machinery.

In 1959, the PRC claimed that output of metallurgical equipment for 1958 was 180,000 tons. Little data has been made available since then, although in June 1976 it was reported that steelmaking equipment for 1975 had reached 1.5 million tons. The major equipment producers are centered in Canton, Fu-la-erh-chi, Harbin, Peking, Ta-lien, Shen-yang, and Tai-yuan.

E. CONSTRUCTION, MINING, AND MATERIALS HANDLING MACHINERY

The construction equipment industry has had low priority in China's industrialization effort, primarily because of the abundant supply of human labor. The industry suffers from inadequate capacity and technology to mass produce many construction machinery components. Moreover, responsibility for output is spread among several machine-building ministries.

Peking, Shanghai, Tai-yuan, Tientsin and Chengtu boast major construction equipment plants. Various mining machinery plants, metallurgical plants, and general machinery plants also produce construction equipment. In fact, a large share of the construction equipment currently produced in China is used in the mining industry.

In spite of the modest manufacturing base of China's construction equipment industry, the PRC can produce at least a limited quantity of almost every type of equipment from simple road rollers to relatively large cranes and dredgers. The equipment produced, however, is primitive and inefficient compared to that produced by the leading Western countries. The largest bulldozer in serial production is a 12-ton, 160 horsepower, model similar to the Caterpillar D–6 of 1945 vintage. The most recently produced dump truck, the Shanghai SH–380, has a payload of 32 tons. While an improvement over its 15-ton predecessor, it is still small when compared to the 100- and 200-ton off-highway trucks manufactured in the United States. Similar differences occur in such types of equipment as concrete mixers, compressors, cranes, power shovels, draglines, dredgers, shovel loaders, graders, road rollers, compactors, and spreaders. Very large machines by Western standards are never produced on a serial basis; they are manufactured for a specific job.

China supplements its own production through large imports of Western equipment, averaging $25 million annually in 1966–75. Demand for foreign construction machinery will continue strong especially for bulldozers, shovel loaders, power shovels of 8-to-15 cubic yard size, hydraulic truck cranes, pipelayers, and off-highway trucks of 80- to 200-ton capacity.

1. MINING EQUIPMENT

Until the 1970s, development of China's mining equipment industry had a low priority. Mining machinery plants constructed with Soviet aid or built indigenously during the Great Leap Forward (1958–60) produced only the most essential extraction and processing machinery, as emphasis was placed on other types of machinery. The growing need for mining equipment prompted Peking to launch a major campaign in 1971 to upgrade the industry and increase mechanization of the country's coal and iron ore mines. Output of mining equipment in 1973 reportedly increased 15 percent over the previous year. Production of ore processing equipment, excavators, and rock drills also increased substantially. Numerous mining machinery plants have been opened near small- and medium-sized mines, and the major mining equipment facilities have increased capacity in support of the mechanization program for major coal and iron ore mines.

Several new items of mining equipment have been trial manufactured or have gone into serial production. In 1971, tunnel boring machines were produced at the Fu-shun Coal Mine Machinery Plant and the Shanghai No. 1 Petroleum Machinery Plant. The Fu-shun model had a boring diameter of 3.8 meters and the Shanghai equipment had a diameter of 3 meters. While it is not known whether the equipment is being serially produced, the technology is representative of equipment used in the West during the 1940s. In 1974, the Shanghai Mining Machinery Plant made China's largest shaft mine drilling machine with a drill bit having a maximum diameter of 7.4 meters. In addition, a number of plants cooperated in developing China's first hydraulic propelled coal mine tunnelling machine in 1975.

Although China has made progress in expanding its mining equipment industry, the coal industry, for example, continues to rely heavily on manual labor or semiautomated mining methods to meet the country's coal production targets. Much of the equipment produced is based on Western prototypes of the preliberation era or on Soviet and East European equipment of the early 1950s. Equipment is often made from inferior steel and requires frequent repair and replacement. The degree of mechanization is uneven, larger mines being the main recipients of heavy equipment while smaller mines rely heavily on human labor.

The PRC leadership is acutely aware of the shortfalls within the mining equipment industry and the need to bolster this sector in order to increase production of coal and iron ore. An article in People's Daily of December 12, 1977 titled "Get More Coal Through Mechanization" urged increased mechanization rather than manual labor to further China's coal output. The article stresses the importance of importing foreign equipment and technology for increasing coal production and developing the base for domestic adaptation. On January 3, 1978, the Minister of Coal Industry, Hsiao Han, outlined China's program for developing the coal industry. According to Han, coal output should be doubled in 10 years and tripled by the end of the century. This can be achieved, Hsiao Han stated, only through large-scale mechanization and modernization of the industry. In a later article written for the Peking Review (February 24, 1978), Hsiao states that China's target is to basically mechanize work in the coal mining sector within 10 years, with the major mines to be equipped with coal-cutters and tunneling machines, continuous transport facilities, automatic coal lifting, washing, and dressing machines, and computerized communications and dispatching systems.

2. MATERIALS HANDLING EQUIPMENT

China produces a fairly wide selection of materials handling equipment including cranes, elevators, forklift trucks, pneumatic loaders and unloaders, and conveyors. Compared with Western equipment, most Chinese machinery is small and the lift capacity is limited. Production of materials handling equipment is carried out by various manufacturing enterprises subordinate to China's construction, mining, transportation, and shipbuilding industries.

Of all categories of PRC materials handling equipment, mobile and stationary cranes offer the greatest variety of sizes and models, ranging from 1-ton truck cranes to a 500-ton floating crane. Mobile cranes comprise the largest subgroup of lifting equipment produced in China, with designed lifting capacities ranging from 1 to 32 tons. In addition, two 65-ton hydraulic crane trucks were trial manufactured at the Chang-chiang Crane Plant in 1977, and a 100-ton motor vehicle hoist was trial produced at the Peking Machinery Plant in 1976. Other mobile cranes with substantially larger lift capabilities are manufactured for railway and port use.

Stationary and floating cranes are an important component of China's materials handling equipment industry. Most are custom made to meet specific requirements, including a 200-ton floating gantry crane built in Canton and a 500-ton floating crane constructed in Tientsin.

Lifting equipment for use in ports includes traveling portal jibs, gantry and still leg derricks, tower transporters, and miscellaneous cargo cranes. In addition, production of handling equipment for ports is being pushed, including fork lift trucks, conveyors, elevators, and pneumatic suction equipment to include bulk grain and coal. New facilities at Whampoa harbor near Canton will have automatic conveyors and suction equipment capable of lifting 400 tons of grain an hour. A new 30-ton capacity gantry crane has also been trial manufactured at the Lien-yuan-hang Machinery Plant in Kiangsu, for handling containers of various sizes including the internationally tandardized 40-foot container.

F. Petroleum Equipment

Since its establishment in the early 1960s, China's petroleum equipment industry has been primarily tasked with turning out basic shallow-well drilling machinery and small scale refining equipment. Output continues to be patterned on antiquated Soviet and East European design technology. Key petroleum equipment plants are the Soviet-designed Lan-chou Petrochemical Machinery Plant and the Shanghai No. 1 Petroleum Machinery Plant. In addition, China has more than 50 small and medium-sized plants and nonspecialized facilities manufacturing various types of petroleum machinery and equipment.

The level of technology in China's petroleum equipment industry lags considerably behind the world state-of-the-art. Most of the drilling equipment produced in China is designed for depths of less than 4,000 meters. China produces rock bits of the three-cone variety for use in both hard and soft core formations, but they are generally of poor quality. It was only in June 1977 that the Chinese announced a new breakthrough in drilling technology with the trial manufacture of a synthetic diamond drilling bit. Ram-type and bag-type blowout preventers are manufactured in China, and a new hydraulically controlled blowout preventer was reported to have been trial manufactured in May 1977 at the Chung-ching Mining Machinery Plant. A variety of geophysical instruments are manufactured, with most technologically dated. The leading manufacturer, the Sian Geophysical Instrumentation Plant, produces logging instruments, seismographs, magnetometers, and isotope well-testing instruments.

Since early 1973, China has purchased more than $350 million worth of foreign petroleum machinery and equipment including seismic surveying and prospecting equipment, downhole equipment, offshore drilling equipment, and such miscellaneous devices as pumps, instruments, pipe laying machines, and oil field transport equipment. Aside from filling a basic void in China's domestic manufacture, imports of foreign equipment offer a valuable source of technology which China will eventually extract and adapt to its equipment design, or perhaps duplicate entirely for indigenous manufacture.

G. Electronics

China has done a creditable job in its development of the electronics branch of machine building. By 1949, war damage and Soviet plundering of Manchuria had reduced China's fledgling electronics base to a fraction of its initial meager capacity. The later rapid development of electronics stemmed from its priority in both the military and industrial programs of the Communist leadership. Since 1961, infusion of foreign technology and equipment has played a critical role in the development of new products and the upgrading of manufacturing capacity.

In spite of rapid progress, shortcomings in product quality and technological sophistication remain. To quote Wang Cheng, Minister of the Fourth Ministry of Machine Building:

> The electronics industry has developed into a well-formed new industry, however, our electronics industry is a relatively weak link; the technical level of its products is not high, its production efficiency is low, and it still cannot meet the needs of national defense and the building of the national economy. There is still a considerable gap between the level of our electronic technology and advanced world levels. We are not (falling any further) behind in developing semiconductors, computers, and other specialized fields, but the gap between us and advanced world levels in other areas has widened * * *

China produces a broad range of electronic equipment, including components (capacitors, resistors, and semiconductors), electronic instruments, computers, communications equipment, consumer products, and specialized military items. Output for 1977 is estimated at $2 billion, twice the level of 1972. Most of the equipment produced is allocated to the military, with the remainder destined for civilian industrial applications. Only a tiny percentage of the industry is involved in the production of such consumer goods as radios, television sets, phonographs, and tape recorders.

China claims to have 2,000 electronics enterprises in all parts of the country. Production takes place in: (a) about 200 major plants employing a total of nearly a half million people; (b) another 500 or so smaller plants employing up to 500 people each; and (c) perhaps 1,500 neighbor community workshops, staffed by housewives and producing electronics elements and parts. Peking, Tientsin, Shanghai, Nanking, Canton, and Chen-tu together account for half of the major plants and three-fourths of production.

China suffers from an extreme technological lag between its state-of-the-art as exhibited by laboratory-produced electronics equipment and its quality of mass production. While China is able in some areas to imitate Western developments of the last decade in one-of-a-kind or small-batch production items, electronics production in the main tends to run 10 years or more behind the world state-of-the-art in terms of embodied technology. As a result, China can be expected to continue its imports of electronics in order to develop basic expertise in all areas of production:

1. *Components.*—Without the development of quality components, China's production of computers, instruments, and other electronic equipment will suffer. The Chinese are seeking mass production technology and plant equipment for integrated circuits and large-scale integration from Japan. China initially sought the technology in 1973 but negotiations apparently came to an end because of internal political turmoil.

2. *Instruments.*—China imports sizable quantities of instruments, because of the unreliability and lack of precision of domestic production, a situation unlikely to change in the near future.

3. *Computers.*—Most of China's computers are one-of-a-kind or batch assembly items developed independently at a number of research institutes and production facilities. Computers in service are clearly inadequate in numbers and capabilities to meet military and industrial needs or to train sufficient personnel in computer applications. Furthermore, the unstandardized output from these varied facilities precludes any rapid development of a common body of knowledge in computer applications and software. China's interest in importing computers has been substantial; recent imports include three highly advanced Hitachi computers bought for $8.6 million to aid meteorological forecasting.

4. *Communications Equipment.*—Chinese emphasis on upgrading telecommunications systems, both civil and military, have been highlighted by a recent national conference which set basic telecommunications development goals. Current accomplishments include development of a national microwave/coaxial cable trunkline and construction of a domestic satellite ground station. The Chinese also have expressed interest in technology for a domestic communications satellite system.

5. *Consumer Goods.*—With continued emphasis on military preparedness and the strengthening of industry, it is probable that transistor radios and other electronic consumer goods will continue

to rate a low prioirty in China's development and import strategems. China has the potential, however, to become a significant exporter of low-priced transistorized consumer entertainment products.

H. Agricultural Machinery

China produces a mix of agricultural equipment including tillers, harvesters, threshers, rice transplanters, and other mechanized and nonmechanized implements; information on levels of production and major producers is scarce. Domestic press discussions of agricultural mechanization in the PRC focus on the production of tractors and powered irrigation equipment. It is in these areas where the Chinese have made considerable progress over the past two decades.

1 TRACTORS

The PRC began trial production of tractors in a handful of plants in the late 1950's while establishing a modern Soviet-aid production facility at Lo-yang. Today, about 80 plants in China are involved in tractor production. Roughly 40 of these plants produce garden tractors (also called walking tractors or hand tractors); the remaining facilities produce medium and large-size tractors (15–150 horsepower). Some plants produce both tractors and walking tractors.

Lo-yang, the largest tractor plant in the country produces 40 to 50 percent of China's total horsepower in medium-to-large tractors. Other major tractor plants include the Hunan and Hupeh Provincial Tractor Works as well as plants in Tientsin, Shanghai, Kiangsi, and Chang-chun. Leading garden tractor plants are located in Shanghai, Peking, Shenyang, and Nan-ning.

China produces 20 or more tractor models which range in size from 3 to 12 horsepower garden tractors to 100–150 horsepower standard tractors. The most common models (model number generally equates with brake horsepower) and their major source of production include the Tungfanghung 54 and 75 (Lo-Yang Tractor Plant), Tieh-niu 55 (Tientsin Tractor Plant), Fengshou 27 and 35 (Kiangsi Tractor Plant, Shanghai), and Hung-chi 75 and 100 (An-shan Tractor Plant). The Shanghai Tractor Plant is the major supplier of Kung-ning 11 garden tractors.

In 1977 China produced roughly 241,000 standard units of tractors and garden tractors (3.6 million drawbar horsepower; 6 million brake horsepower). This figure includes 156,000 standard units of tractors and 85,000 of garden tractors.[2]

2. POWERED IRRIGATION EQUIPMENT

Powered irrigation equipment is crucial to China's maximization of arable land, a major factor when dealing with the incredible task of trying to feed close to a billion people. Irrigation equipment facilitates cultivation in low-rainfall areas and makes extensive terraced farming practical in China's many hilly regions.

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[2] A standard unit is 15 drawbar horsepower; tractor model numbers, however, indicate their brake housepower. A tractor's drawbar horsepower is usually 50–70 percent of its brake horsepower; thus a Tungfanghung 25 has a brake horsepower of 25, a drawbar horsepower of 15, and is equal to 1 standard unit. Similarly a Kung-nung 11 garden tractor has a brake horsepower of 12, a drawbar horsepower of 6.6, and is equal of 0.44 standard units.

Production of powered irrigation equipment is basically an assembly process involving pumps and diesel engines, whose production is discussed elsewhere. Since 1967 the Chinese have assigned this assembly to the local governments. All provinces, municipalities, and autonomous regions have their own plants.

China averages about 6 million to 7 million horsepower per year in output of powered irrigation equipment, nearly 10 times the 640,000 horsepower produced in 1963. The national inventory of such equipment (total horsepower currently in use) reached 20 million horsepower in 1971, 30 million in 1973, and 40 million in 1975, but only 47 million by 1977. The recent slowdown in inventory growth may be due to production setbacks and to an increased level of depreciation of older equipment.

I. General Industrial Machinery

China produces a broad range of general industrial machinery, including pumps and compressors, blowers and fans, ball and roller bearings, gas turbines, and motors and welding equipment. This equipment covers a wide range of technologies extending from simple irrigation pumps manufactured at local plants to the complex units found in chemical processing industries. Except for selected priority areas, technology lags at least 20 years behind the Western state-of-the-art. China thus must import both: (a) Specific equipment items; and (b) complete plants to manufacture general industrial machinery such as high pressure centrifugal compressors, roller and ball bearings, and machinery and equipment for manufacturing gas turbines.

1. PUMPS, COMPRESSORS, AND BLOWERS

China manufactures a variety of centrifugal and axial pumps for use in agriculture, the chemical industry, and in power stations. A large share of pump production goes for irrigation purposes. These are mostly shallow-well pumps driven by electic motor or small diesel engines. Deep-well pumps and pumps for the mining and petroleum industries are in short supply and have to be imported. The Shanghai Pump Factory is the leading producer. Other large producers are located in Peking, Shen-yang, Chang-sha, and Fo-shun.

Chinese compressors have a broad range of industrial applications. Air compressors generally fall into two categories, those which have agricultural and relatively light industrial application and those which are used in the transportation, construction, and other heavy industrial sectors. The majority of compressors are built for use primarily in agriculture for spraying pecticides. Many intermediate size compressors are used to supply compressed air for pneumatic tools and machines. More powerful compressors are employed in mining and chemical processing.

Major compressor manufacturing plants are located in Shanghai, Nan-king, Wu-shi, Peking, Chung-king, Canton, Shen-yang, Pang-pu, Kuei-yang, and Shao-kuan. The Shanghai facility produces a wide variety of equipment including mobile and air compressors for use in oil refining. Industrial blowers are manufactured at Chang-sha, Shanghai, Shen-yang, Peking, and Tientsin; this equipment has wide application in the mining, petrochemical and metallurgical industries.

2. BALL AND ROLLER BEARINGS

Production of bearings has expanded only slightly since the infusion of Soviet equipment and technology in the 1950's. Production probably totals 50–80 million sets per year, far short of installed capacity. While the ball bearing is the most common variety, China also produces spherical and cylindrical roller bearings, needle bearings, and sliding bearings. As for quality control, standard Chinese practice is to select out the better berings for strategic and priority needs and to relegate the substandard bearings to less crucial applications.

Half of the bearing production can be attributed to 30 medium-to-large scale plants; the biggest plants are located in Lo-yang, Harbin, Wa-fang-tien, Peking, and Shanghai. The larger plants generally produce higher grade and specialized bearings for national and regional distribution; 50 or so smaller plants provide a local source of supply for bearings needed in agricultural equipment, transport, and light industry.

Standard grade production requirements are transferred to the smaller plants as the larger plants improve their capabilities. Large plants also provide training and equipment in the establishment of local sources of production. For example, the Lo-yang Bearing Plant in 1972 was reported to have built 11 small bearing plants, in farm areas, equipped 20 more, and trained 300 skilled workers for these plants.

The lack of adequate machine tools, qualified engineers, and limited technology has prompted China to make large scale purchases of ball and roller bearings from Japan, West Germany, France, Sweden, Switzerland, and the United States. Moreover, China has purchased a number of complete production facilities from abroad, including the manufacturing know-how. In addition, China has been seeking selected pieces of bearings, forging, and metalworking machinery to enhance domestic production capabilities.

3. GAS TURBINES

In 1974, the Shanghai steam turbine plant trial produced the first 6-megawatt turbine for power use. Prior to this, the Nanking steam turbine generator plant announced the trial manufacture of a 1-megawatt mobile gas turbine generator unit. In 1971, the Chinese claimed that a 3,000 horsepower gas turbine locomotive had been trial manufactured. The Chinese also announced in January 1978 the trial manufacture of a 4,000 horsepower gas turbine locomotive which was made at the Chang-chun locomotive plant; this may be the same engine with additional improvements.

The PRC gained considerable expertise in gas turbine technology by buying foreign equipment and manufacturing know-how. Gas turbines for power generation purposes have been imported from Belgium, Canada, Japan, Sweden, and the United Kingdom. Also, the Chinese are acquiring considerable know-how in the $200 million contract with the United Kingdom for Spey aircraft engine manufacturing technology. Purchases of special purpose machine tools that have unique application in the gas turbine manufacturing area have also been stepped up.

Industrial gas turbines have wide application in pipeline compression stations, in utility power units on oil rigs, and in power generation at remote oilfields. The electric power industry employs gas turbine generating units to meet the peak power needs of major industrial centers. Requirements for gas turbines also exist in the transportation sector for aviation engines, engines for off-highway vehicles, and high-speed marine engines. Development of most types of gas turbines is still in its infancy in China; it may be 5 years or more before gas turbine production is well established.

4. MOTORS

China produces a broad range of electrical machinery and equipment for industrial application, including motors, generators, welding machines, and various types of capacitors and rectifying units. General purpose motors and generators are fairly extensively produced for use in agriculture and industry and for export.

When China started exporting general purpose motors in 1958, the JO series standard induction motor was the only export model. China is now able to supply alternating current motors, direct current motors, fractional horsepower motors, clutch-driven motors, and oil-pump-type motors in 27 series and over 600 variants. Motor ratings range from 1/100 horsepower for instruments and meters to 2,000 horsepower units for steel rolling, metallurgy, and marine operations. China also produces four series of single-phase and three-phase synchronous generators for export, as well as diesel generating sets ranging from 5–120 kilowatts.

A large share of China's motor and generator output comes from plants producing heavy power generation equipment, although many specialty plants are scattered throughout China. The Harbin electrical machinery plant, for example, produces a variety of motors and generators, including 10,000 kilowatt alternating current units and 500 kilowatt direct current units. The Shanghai electrical machinery plant can produce large, medium, and small direct current generators with capacities of 50,000–60,000 kilowatt, 500–600 kilowatt, and 50–60 kilowatt. Numerous specialty plants producing miniaturized as well as standard size motors are scattered throughout the country. As in other areas of power generation equipment development, China has had difficulty in producing large-capacity high speed motors of medium weight and low moment of inertia. Equipment of this type has been manufactured in the West for many years and is representative of a country's progress in the industrial power equipment industry.

5. WELDING EQUIPMENT

Welding equipment has wide application in China's machine-building industry. Buildings, bridges, pressure vessels, piping, ships, and other transportation vehicles, rockets, and television sets all use welded joints. The arc welding process accounts for much of China's welding equipment manufacture. Major plants producing such equipment, for domestic use as well as for export, are located in Cheng-tung, Chu-chou, Kuei-yang, Shanghai, Shen-yang, and Tientsin.

The Shanghai electrical welding machinery factory is a leading manufacturer and developer of welding equipment in China and has trial produced several types of advanced welding equipment. The plant serially produces automatic and semiautomatic arc welders, spot and seam resistance welders, electroslag welding machines, vacuum electron-beam equipment, ultrasonic and high-frequency devices, and fusion-cutting apparatus. In addition, China produces some flash welding equipment and cold pressure welders.

6. STORAGE AND DRY BATTERIES

Nearly every province and major municipality has at least one dry battery plant, and storage batteries are produced in most major industrial centers. In recent years, there has been considerable advance in the variety and types of batteries produced and in their efficiency and performance. China is a major exporter of batteries, including 6 volt and 12 volt units suitable for heavy and light trucks, buses, cars, and motorcycles.

J. Special Industrial Machinery

China produces a broad range of special industrial machinery for the food products industry, textile industry, woodworking and paper industries, printing trades industry, plastic and rubber industries, and the chemical industries. With the possible exception of the textile equipment industry, most of the equipment produced is simple in design and lacks the sophisticated quality control and automation devices common to Western machinery. Most of the special industrial machinery produced in China is used domestically; attempts have been made to export the machinery in volume, particularly to Southeast Asia and other Third World areas.

In the food-processing area China has had little, if any, capability to manufacture the modern packaging and labeling equipment needed to effectively compete with major world suppliers of packaged food products. While the number of canneries in China has increased considerable over the past several years, the machinery installed is obsolete by Western standards. Efforts to upgrade the food packaging industry were strengthened in 1974 when China established the National Export Commodities Packaging Corp. within the Ministry of Foreign Trade. The organization has primary responsibility for importing packaging machinery and related technology. In addition, several Chinese packaging equipment delegations have visited Western manufacturing facilities, and foreign delegations have been invited to China to present seminars on Western packaging techniques.

CHINA'S ENERGETICS: A SYSTEM ANALYSIS

By Vaclav Smil*

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INTRODUCTION

Chinese energetics presents a thoroughly intriguing, highly complex and, in not a few aspects, continuously puzzling case. In absolute terms, the country's fossil fuel and hydropower resources rank with—or even above—those of the United States and the Soviet Union. Globally, China has risen to the fourth place in primary energy production (following the United States, the Soviet Union, and Saudi Arabia) and to the third place in consumption (behind the two superpowers) and, in the process, has become not only self-sufficient but also a minor fuel exporter. And yet, at the same time, China's energetics is definitely that of a rather poor, developing country where large segments of rural population still depend on plant fuels and animate power and whose per capita modern energy consumption ranks close to the one-hundredth place in the global array of some 175 countries and territories.

The future seems no less ambiguous. While the probabilities for retaining the energy self-sufficiency and expanding the crude oil and coal exports are very high throughout the 1980's, the potential fuel and electricity requirements for the modernization of the Chinese economy are immense and it seems quite improbable that they could be filled satisfactorily with the sole reliance on domestic technology. And even under circumstances favoring a very fast expansion, the country's per capita energy consumption by the year 2000 would equal the levels attained by most of the Western societies already during the first two or three decades of this century.

Although these developments and prospects have recently attracted a good deal of research attention,[1] their assessment remains a rather difficult and, repeatedly, very frustrating task for any energy analyst familiar with the work and data base available for other major consuming nations.[2] The amount of information completely missing in the Chinese case is staggering[3] and much of what is accessible is unpredictably fragmentary and, too often, of dubious quality. What follows, then, is just the best attempt—under rather restrictive circumstances—to apply the approaches of general system analysis to the energetics of the world's most populous nation.

RURAL ENERGY FLOWS

One of the major shortcomings of most national energy studies is, as R. H. Socolow puts it, that "solar energy doesn't count."[4] Attention is focussed on fossil fuels and solar energy other than as hydroelectricity is not included in the analysis. While always regrettable, the omission is not critical for the Western industrialized nations, or for Japan, with their heavy dependence on oil, coal, and natural gas; for developing countries, however, it represents a serious error. Most of the population in these countries is rural, and until fairly recently it has been either completely separated from, or only marginally involved in, the flows of modern commercial fuels and electricity.

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[1] Most of this information has been summarized and evaluated in my "China's Energy Achievements, Problems, Prospects" (New York, Praeger Publishers, 1976).

[2] To appreciate the wealth of information available on energy in the United States, other OECD nations and also the U.S.S.R. see, among scores of others, Congressional Research Service, "Project Interdependence: U.S. and World Energy Outlook through 1990" (Washington, D.C., USGPO, 1977), and Workshop on Alternative Energy Strategies, "Energy Demand Studies: Major Consuming Countries" (Cambridge, Mass., MIT Press, 1976). Incomparably more material is also available for the largest energy consumers among the developing nations—India, Brazil, and Mexico.

[3] Systematic knowledge is completely lacking in critical areas of energy development and production financing and costs; output allocation and pricing; fuel extraction rates and conversion efficiencies and final sectoral uses.

[4] R. H. Socolow, "Energy Conservation" in J. M. Hollander, M. K. Simmons, and D. O. Wood, eds., "Annual Review of Energy," vol. 2 (Palto Alto, Annual Reviews, 1977), p. 241.

China, with four-fifths of its vast population living in the countryside, is the foremost example of a nation where most of the people are still relying on solar energy to produce, via photosynthesis, not only their food and feed for the animals—but also the necessary fuel and raw materials. For a better appreciation of China's solar energetics I have attempted to quantify all the essential sources, conversions, and uses of energy in the country's rural areas during 1 year:[5] they are systematically discussed below, their derivations are presented in detail in appendix B, and a simplified flow graph is shown in figure 1.

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[5] The selected year, mainly because of a relative abundance of available data at the time of researching this complex topic, is 1974, the 25th year of the PRC's existence.

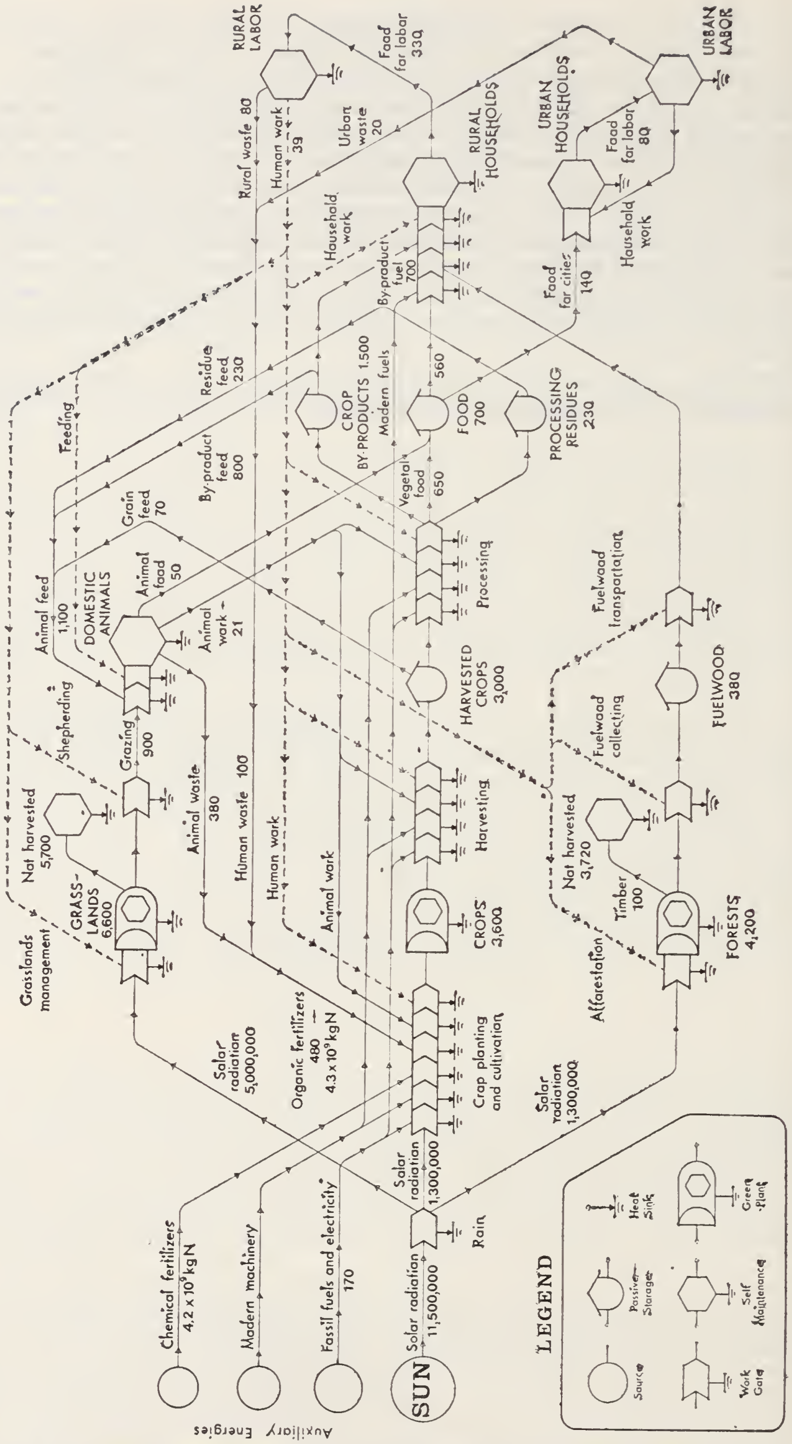
Auxiliary Energies
Chemical fertilizers 4.2 x 10⁹ kg N
Modern machinery
Fossil fuels and electricity* 170
SUN
Solar radiation 11,500,000
Rain
Solar radiation 1,300,000
Solar radiation 5,000,000
Solar radiation 1,300,000
Organic fertilizers 480 — 4.3 x 10⁹ kg N
Crop planting and cultivation
CROPS 3,600
Harvesting
HARVESTED CROPS 3,000
Processing
Vegetal food 650
FOOD 700
560
CROP BY-PRODUCTS 1,500
Modern fuels
PROCESSING RESIDUES 230
By-product feed 800
Residue feed 230
By-product fuel 700
RURAL HOUSEHOLDS
Household work
Food for cities 140
URBAN HOUSEHOLDS
Household work
Food for labor 80
URBAN LABOR
Urban waste 20
Food for labor 330
RURAL LABOR
Rural waste 80
Human work 39
Grasslands management
GRASS-LANDS 6,600
Not harvested 5,700
Grazing 900
Shepherding
DOMESTIC ANIMALS
Animal feed 1,100
Feeding
Grain feed 70
Animal food 50
Animal work 21
Animal waste 380
Human waste 100
Human work
Animal work
Afforestation
FORESTS 4,200
Timber 100
Not harvested 3,720
Fuelwood collecting
FUELWOOD 380
Fuelwood transportation
LEGEND
Source
Passive Storage
Heat Sink
Work Gate
Self Maintenance
Green Plant

FIGURE 1.—Rural energy flows in China in 1974. All figures, except those for nitrogen fertilizers, are in trillions (10^{12}) kcal. Derivation of all flows is discussed in app. B.

Insolation and Phytomass Production

Average annual solar radiation with cloudless sky would range between 160 kcal per cm^2 in the northernmost Heilungkiang to 235 kcal per cm^2 in Hainan and China would receive approximately 20×10^{18} kcal of energy each year.[6] Actual duration of sunshine is strongly reduced by frequent heavy cloudiness accompanying summer cyclonic flows over much of the eastern half of the country and intensity of insolation is appreciably attenuated during late winter and spring months by large quantities of sand and dust swept up from the arid northern regions by continental anticyclonic winds. Solar energy received at the surface is thus only between 100 and 140 kcal per cm^2 per year for most of China, and the annual total does not exceed 11.5×10^{18} kcal.

More than half of this radiation is either reflected or absorbed and reradiated by barren or only sparsely vegetated surfaces: Mountain and plateau tundra, stone and sand deserts, and low-productivity shortgrass steppes cover about 56 percent of China's territory—mostly in Sinkiang, Tibet, Tsinghai, Kansu, and Inner Mongolia—and their combined net primary production is less than 4×10^{15} kcal of plant mass annually. Tibetan plateau meadows and temperate grasslands of the North and the Northwest occupy 20 percent of the total area and produce each year about 4×10^{15} kcal of phytomass. Forests, concentrated above all in Heilungkiang and in the South and the Southwest, account for only less than 12 percent of the land, and their total productivity—just over 4×10^{15} kcal—is actually smaller than that of the grasslands (table 1).

TABLE 1.—PRIMARY PRODUCTIVITY OF CHINA'S MAJOR VEGETATION UNITS

		Net primary productivity			Annual energy fixation	
Vegetation unit	Area ($10^3 km^2$)	Average (g/m^2/year)	Total production (10^6 tons)	Mean caloric value (kcal/g)	Average (10^3kcal/m^2/year)	Total (10^{15} kcal)
Forest	1,100		935			4.18
Boreal forest	660	500	330	4.8	2.4	1.58
Temperate mixed forest	110	1,000	110	4.7	4.7	.52
Raingreen forest	330	1,500	495	4.2	6.3	2.08
Grassland	4,150		1,645			6.58
Shortgrass steppes	2,150	300	645	4.0	1.2	2.58
Temperate grassland	2,000	500	1,000	4.0	2.0	4.00
Tundra	2,150	100	215	4.0	.4	.86
Desert	1,070	70	75	4.5	.3	.34
Cultivated land	1,090	810	880	4.1	3.3	3.60
Total for China	9,560		3,750			15.56

While the above plant productivity figures are merely approximation of the proper order of magnitude, net energy conversion of agricultural crops, which cover nearly 11.5 percent of China's land, can be established more reliably by accounting for all principal harvested plants and then increasing these totals by appropriate amounts of byproducts and unharvested roots. In 1974, China's harvest reached approximately 250 mmt of dry matter in food and industrial crops, and nearly twice that amount in crop residues for a total of 3×10^{15} kcal; roots increase the total by another 20 percent. Net primary production of all of China's ecosystems is thus around 15×10^{15} kcal, which means that approximately 0.14 percent of solar energy reaching the surface is being converted annually by autotrophs into new plant mass.[7]

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[6] Abbreviations of all units used in the text, notes, and appendices to this paper are explained in appendix A.

Domestic Animals

Domestic animals provide several very important links in a predominantly solar economy: they function well on light energy, feeding mostly on plant tissues unsuitable for human consumption—grasses, crop byproducts, and crop processing residues—supplemented with only minor amounts of grain;[8] they deliver the essential power for many farm tasks (fieldwork, irrigation, food processing, transportation); they recycle the valuable nutrients by their often copious and, when mostly stall- or pen-fed, conveniently concentrated manure production; and finally, they are a critical source of protein (in meat, entrails, and milk) and fat (lard, butter, tallow) for the population.

More than four fifths of the total feed energy for China's domestic animals—over 100 million of large beasts, some 130 million of sheep and goats, about a quarter billion of pigs, and nearly 1.3 billion of chickens, ducks, and geese—is supplied by roughages provided by grazing, collection of field weeds and a variety of crop byproducts (millet, rice, and oat straw and legume and potato vines are fed most widely). Concentrates come predominantly as milling and extraction residues (chaffs, brans, oilseed cakes, sugar refining wastes) and, to a smaller degree, from direct feeding of grains (barley, corn, millet, oats), legumes and potatoes (mainly the sweet ones). The total energy equivalent of animal feed amounted to some 2×10^{15} kcal in 1974 and nearly 40 percent of it was consumed by large domestic animals—cattle, water buffaloes, horses, asses, and mules—which are still an indispensable workforce in China's agriculture: an evaluation of animal labor shows that the draft beasts performed the equivalent of some 20×10^{12} kcal of useful work in 1974 (table 2).

TABLE 2.—USEFUL WORK PERFORMED BY CHINA'S DRAFT ANIMALS IN 1974

Animals	Average weight (kilograms)	Average draft (kilograms)	Average speed of work (meters per second)	Average horsepower	Hours worked per year	Total numbers in 1974 (10^6)	Useful work performed in 1974 (10^{12} kcal)
Cattle	385	39	0.70	0.36	1,000	63.5	9.7
Buffaloes	500	50	.70	.46	1.200	30.0	7.0
Asses	350	35	.70	.32	1,100	11.7	1.7
Horses	350	53	1.00	.70	1,100	7.0	2.3
Mules	350	53	.95	.66	1,100	1.6	.5
Total						113.8	21.2

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[7] Global net energy fixation of land plants is nearly 0.3 percent of annual solar radiation (full spectrum) at the Earth's surface: lower conversion rate for China is due to a very low productivity of the country's vast, dry, and barren interior. Net primary productivity of China's vegetation is thus only about 3.5 percent of the world total, although the country's territory covers nearly 6.5 percent of the global landmass.

[8] H. T. Odum, "Environment, Power, and Society" (New York, Wiley-Interscience, 1971), pp. 105–109.

No less important is animals' contribution to maintain the fertility, as well as to improve the tilth, of the country's soil. China's domestic animals produce annually about 1.1 bmt of manure (approximately 200 mmt of dry solids) and nearly two-thirds of this huge total are carefully gathered, fermented and returned to the fields.[9]

Human Energetics

Conversion of solar radiation by edible plants is, naturally, the main source of food energy for China's large population. Construction of a national food balance sheet indicates that out of the total 1974 harvest of approximately 470 mmt (field weight) of food crops no more than 65 percent became actually available for human consumption: processing (milling, oil and sugar extraction) and storage wastes, seed and feed account for the difference. Rice, wheat, corn, sweet potatoes and millets are by far the most important sources of calories providing some four-fifths of plant food energy available in China; legumes, vegetables, and vegetal oil are also indispensable, while the contribution of animal foods to national consumption total was only about 7 percent in 1974 (table 3).

TABLE 3.—AVAILABILITY OF FOOD ENERGY IN CHINA IN 1974

	Total food (million metric tons)	Total energy (10^{12} kcal)	Share (percent)
Vegetal foods	302.6	650.0	92.9
Cereal products	138.7	492.0	70.3
Tubers	69.4	64.5	9.2
Legumes	14.1	48.5	6.9
Other vegetal foods	80.4	45.0	6.5
Animal foods	27.4	50.0	7.1
Meat, poultry, and fish	19.6	35.5	5.1
Other animal foods	7.8	14.5	2.0
Total	330.0	700.0	100.0

Depending on the mid-1974 population total used—862 million people according to Leo A. Orleans and 917.25 million people estimated by John S. Aird—the average daily per capita consumption would be no less than 2,090 kcal and as much as 2,225 kcal.[10] These figures alone are insufficient to evaluate the country's food energy status: for this food consumption must be compared with energy needs which are the function of age, sex, weight, and physical activity.

Precise recent information is not available for any of these variables but reasonable estimates can be made to calculate the likely energy requirements. Age-sex distributions have been computed by John S. Aird, typical Chinese weights can be derived by reducing the Harvard-Iowa age-weight table values by about 10 percent, and the standard calculations can be done assuming moderately active populations at a given age and weight. These assumptions result in the nationwide energy needs of about 710×10^{12} kcal (table 4), and would indicate a rough balance between the requirements and availability.

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[9] For most areas in China recycled organic matter remains the dominant fertilizer: "China's agriculture uses mainly organic or farm manure. Chemical fertilizers are only supplementary * * * the sources of manure are constant and expandable. Collecting it takes manpower but little or no investment." ("Expanding Sources of Fertilizer and Using it Rationally," China Reconstructs, vol. 26, no. 6 (June 1977), p. 19.)

[10] For comparison, the 1974 food supply for other populous developing nations was calculated by the FAO as follows (all figures in kcal/day/capita): India 1,971; Indonesia 2,128; Brazil 2,515; Bangladesh 2,023; Pakistan 2,132; Nigeria 2,084; Mexico 2,725; Philippines 1,963 (FAO, "1976 Production Yearbook" (Rome, FAO, 1977), pp. 243–245).

TABLE 4.—CALCULATION OF FOOD ENERGY REQUIREMENTS FOR THE CHINESE POPULATION IN 1974

Age group (years)	Average body weight (kilograms)	Energy requirements for moderate activity (kcal/day/capita)	Population distribution (millions)	Total energy requirements (10^{12} kcal)
Children:				
Less than 1		1,000	26.45	9.65
1 to 3	12	1,400	79.85	40.80
4 to 6	19	1,800	76.05	49.96
7 to 9	26	2,200	69.17	55.54
Males:				
10 to 12	34	2,600	32.18	30.54
13 to 15	48	2,200	30.14	24.20
16 to 19	57	2,700	39.81	39.23
20 to 39	60	2,800	132.70	135.61
40 to 49		3,600	43.14	40.94
50 to 59		2,500	28.82	26.30
60 to 69		2,100	17.96	13.77
70 plus		1,800	8.95	5.88
Females:				
10 to 12	34	2,300	31.55	26.49
13 to 15	45	2,000	29.68	21.67
16 to 19	50	2,100	39.03	29.92
20 to 39		2,000	127.68	93.20
40 to 49		1,900	42.78	29.67
50 to 59		1,800	30.67	20.15
60 to 69		1,500	19.70	10.79
70 plus		1,300	10.94	5.19
Total			917.25	709.50

However, the standard calculations undoubtedly underestimate the energy needed by the rural labor force. Much of the Chinese agriculture is still traditional and most of its labor tasks—ploughing, hoeing, watering, weeding, mowing, loading—belong to the heavy, rather than moderate, energy expenditure category. So do other activities which are now prominent in many villages: Forestry, coal mining and, above all, off-season repair or building of water control projects and extension of cultivable lands. These projects require exceptionally heavy exertion in digging, ridging, lifting, and moving heavy loads and the Chinese claim that at least 100 million people have been engaged in these activities every winter and spring since 1971. Eleven provincial totals (adding up to 62 million people participating in the water control work) released during the winter months of 1974–75 indicate that on the average about 65 percent of the rural labor force took part in such off-season work.

Considering these facts it would seem reasonable to conclude that at least half of China's economically engaged (16–59 years) rural population (80 percent of the national total) should be classified as very active. This assumption would raise the total energy requirements of the rural labor force by some 30×10^{12} kcal annually and would imply a slight national food energy deficit of about 5 percent. Such a deficit would not be a sign of nationwide chronic malnutrition; rather it would indicate the existence of regional disparities—the areas where the people are consuming more than their essential energetic balance requirements and the regions where caloric intake is, at best, sufficient to cover the basic metabolic and work needs but where recurrent food shortages are not compatible with vigorous and healthy life. This interpretation has been lately confirmed by reports coming from China.[11]

As for the accounting of useful work performed by the rural labor force, three different methods yield very similar totals—around 100,000 kcal per adult per year. Economically active rural population of 390 million men and women would then contribute some 39×10^{12} kcal of useful energy in 1794, implying an overall efficiency of about 11 percent. Finally, recycling of human waste, both rural and urban, returned about 1.6 mmt of nitrogen to the country's fields.

Traditional Fuels

For millenia the Chinese civilization has been deriving its kinetic energy from human and animal muscles and its thermal requirements from forests. Extensive use of wood not only as a household and industrial fuel but also for building cities, cremating the dead and producing black writing ink resulted in dangerous deforestation over vast areas. Prodigious afforestation efforts during the past quarter century have not always had the expected results: Proper forest management has been almost nonexistent, survival in terms of number of stems was typically no more than 10 percent and new plantings were often crippled by reckless pruning; the situation has improved only in the last few years.[12]

Not surprisingly, there is no official record of forest fuel use in China and there are no plantations maintained specifically for firewood. The fuel comes from scavenging of forest-floor debris, lopping of branches and removal of dead trees (and also from illegal cutting and uprooting of the healthy ones) [13] in accessible wooded areas and from pruning of remaining or newly planted roadside trees in deforested regions, where any other kind of vegetal matter—reeds on the stream and canal banks, leaves and grasses—is also collected.[14] Fuelwood consumption in China, as anywhere else in the developing world, cannot be quantified with a high reliability. A Chinese source put it at 35 million m^3 in 1952, Richardson estimated that at least 100 million m^3 were used annually in the early 1960's and the latest FAO figures range between 129 and 142 million m^3 for the years 1970–75.[15] An ecological derivation of forest fuel consumption in China provides an excellent confirmation of the FAO estimates: It is most likely that an equivalent of some 140 million m^3 of wood was removed for fuel from China's forests in 1974.[16]

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[11] For example, in Kweichow in 1976 each person directly involved in agriculture produced only 68.2 percent of the national average for 1975 and the peasants' average grain rations were only 76.8 percent of China's mean: Kweichow provincial broadcast, BBC, "Summary of World Broadcasts (SWB)," FE/W894/A/1 (Sept. 8, 1976); people in Szechwan "have been taught to persist in consuming grain in a planned and thrifty way": Szechwan provincial broadcast, SWB, FE/W943/A/2 (Aug. 24, 1977).

[12] S. D. Richardson, "Forestry in Communist China" (Baltimore, Johns Hopkins, 1966), p. 14, and J. Westoby, "Whose Trees? Whose Science?", New Scientist, vol. 74, No. 1013 (Aug. 12, 1976), pp. 341–343.

[13] State Council of the PRC promulgated "Regulations Governing the Protection of Forests" on May 27, 1963 (for a full English translation see Richardson, op. cit., pp. 177–184) which specify that anyone cutting a tree without appropriate permission must plant three replacements in addition to paying compensation.

[14] This time-consuming task—essential yet unrewarded by any workpoints—is usually done by children or grandparents to free the parents for communal work.

[15] Lin I-tse, "World Forest Resources and Lumber Production", "Chi-hua Ching-chi (Planned Economy)", No. 11 (9 November 1953), pp. 33–34; quoted in CIA, "People's Republic of China: Timber Production and End Uses" (Washington, CIA, 1976), p. 3; S. D. Richardson, op. cit., p. 13; FAO, "1975 Yearbook of Forest Products" (Rome, FAO, 1977), pp. 17–18.

Grasses are widely collected in deforested regions but by far the most important plant fuel in such areas comes from crop residues. Although all of the principal crop byproducts—rice, wheat and millet straw, corn and cotton stalks and potato, legume and vegetable vines—have a wide variety of competitive uses as animal feed and bedding, for composting, thatching, fencing, and packing as well as raw materials for the manufacture of hats, sandals, ropes, bags, mats, and paper, their consumption as fuel continues to be very important throughout China: a conservative accounting yields the annual usage of 175 mmt, the equivalent of some 700×10^{12} kcal.

Solar Economy in Transition

In their effort to modernize agricultural production and to raise the rural living standard the Chinese have substantially increased the flow of modern energies in the countryside: 1974 direct fossil fuels and hydroelectricity consumption in agriculture reached perhaps as much as 170×10^{12} kcal[17] and the total rural use of commercial energy, including coal and hydropower from small enterprises consumed by local industries and households, climbed to nearly 500×10^{12} kcal,[18] nearly 4 times the amount a decade ago.

Nevertheless, in the same year crop byproducts and wood still contributed more than twice as much fuel energy—some $1{,}100 \times 10^{12}$ kcal. Similarly, the capacity of mechanical pumps and tractors had more than quintupled in a decade to 49 million horsepower,[19] yet the capability of the draft animals (approximately 30 million horsepower) and the rural labor force (the equivalent of another 30 million horsepower) was still about one-fifth larger.[20] And although the importance of organic fertilizers has been relatively shrinking they, too, retain their essential role: In 1974 some 4.2 million tons of nitrogen were available in China from domestic production and imports of synthetic fertilizers[21]—but even a conservative estimate yields at least an equal amount of nitrogen recycled from animal and human wastes.

These figures clearly demonstrate that most of China's rural population continues to live as do hundreds of millions of other poor peasants around the world—in solar-dominated ecosystems, largely independent on external energy subsidies. Even for the nation as a whole solar energy recently transformed by green plants still predominates: approximately 4.1×10^{15} kcal of phytomass energy—as food, feed, fuel and raw material—were used to support China's people and animals in 1974, while the total flow of fossil fuels and primary electricity amounted to less than 2.65×10^{15} kcal.[22] In contrast, the commercial energy consumption in the United States, a nation with almost identical size of the territory though with only less than a fourth of China's population, reached about 18.4×10^{15} kcal in 1974, surpassing about 7.5 times the energy value of plants harvested as food, feed or raw material.[23]

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[16] For comparison, in the same year the Indian consumption was 110 million m^3, the Soviet 83.4 million m^3 and the U.S. firewood harvest was only 14.1 million m^3 (FAO, "1975 Yearbook of Forest Products," loc. cit.)

[17] CIA estimate is 24 million tons of coal equivalent, which would be exactly 168×10^{12} kcal (CIA, "China: Economic Indicators" (Washington, D.C., CIA, 1977), p. 27)): my own estimate is somewhat lower: 18.2 million tons of coal equivalent, or 127×10^{12} kcal (V. Smil, op. cit., p. 150).

[18] Assuming that virtually all small coal mine output (110 mmt or 462×10^{12} kcal) and one-third of all hydroelectricity (9 billion kWh or 7.8×10^{12} kcal) is used in rural areas, the total consumption, including liquid fuels for farm machinery, would reach no more than 490×10^{12} kcal.

[19] In 1974 inventory of powered irrigation equipment reached 36 million horsepower and the tractor park totaled 12.5 million horsepower: CIA, "China: Economic Indicators", op. cit., p. 13.

[20] Total animal power was calculated from figures in Table 2 assuming, once again, that only two-thirds of animals are actually available for work; total human potential was calculated by assuming rural working population of about 390 million people and power of 0.075 hp/person (that is around 5.5 kilogram-meters per second for continuous work).

[21] A. L. Erisman, "China: Agriculture in the 1970's" in "China: A Reassessment of the Economy" (Washington, D.C., USGPO, 1975), p. 333.

However, China is today in the midst of a massive rural modernization effort and her countryside is approaching the crucial energy divide: Before too long the system will be more dependent for its functioning on auxiliary energies (fossil fuels and electricity) than on organic fuels and wastes and on animate power. It is a unique characteristic of the Chinese energetics that the foundations of this critical transformation have not been laid solely by a hierarchical transfer of advanced technology but, to a large degree, through the application of appropriate small-scale processes.

MODERNIZATION WITH SMALL-SCALE TECHNOLOGIES

Although the Chinese commitment to small energy technologies has not been an unqualified success, the basic soundness of the approach cannot be questioned: For the world's largest developing nation with vast and poor countryside, deep regional disparities, meager transportation infrastructure and limited investment capacities, a huge labor force and scattered resources are certainly among its crucial assets and their utilization through appropriate technologies represents undoubtedly a rational strategy at this stage of development. The Chinese have turned into reality, on a scale larger than anywhere else in the world, Ernst F. Schumacher's advice to developing, and also to developed, nations: (1) Make things small where possible. (2) Reduce the capital-intensity because labor wants to be involved. (3) Make the process as simple as you can. (4) Design the process to be nonviolent.[24]

The approach—adopted by necessity during Yenan years,[25] discarded during the first Five Year Plan in favor of the Stalinist model and employed indiscriminately and injuriously during the Great Leap Years—seems to have found its proper niche during the past 10 years and its contribution to China's energetics has become very significant.[26]

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[22] It should be stressed that about half of all plant energy is the animal feed and bedding, about one-quarter is fuel and only about 16 percent is vegetal food (Figure 1); caloric equivalent of primary commercial energy is based on the 1974 consumption of 377 mmtce.

[23] According to the USBC, "1976 Statistical Abstract" (Washington, D.C., USGPO, 1976), p. 549, the 1974 national primary energy consumption equalled $72{,}933 \times 10^{12}$ Btu or 18.4×10^{15} kcal. Energy equivalent of all U.S. food and feed crops harvested in 1974 totaled about 1.5×10^{15} kcal (data on field crop, fruit and hay harvest were taken from USDA, "Agricultural Statistics 1976" (Washington, D.C., USGPO, 1976), pp. 1–296) and that of timber and fuelwood (according to the USBC, op. cit., p. 681) was about 0.95×10^{15} kcal for a total of about 2.45×10^{15} kcal.

[24] Ernst F. Schumacher, "Economics Should Begin with People, Not Goods," The Futurist, Vol. 8, No. 6 (December 1974), p. 274.

[25] For the most comprehensive description of the genesis of small industries in the Shensi-Kansu-Ninghsia Border Region see Peter Schran, "Guerilla Economy" (Albany, State University of New York Press, 1976).

[26] Most of the following material on small coal mines and small hydro stations is taken from my previous summaries of the topic: V. Smil, "China Opts for Small Scale Energy Technologies," Energy International, Vol. 13, No. 2 (February 1976), pp. 17–38; V. Smil, "Intermediate Energy Technology in China," World Development, Vol. 4, Nos. 10–11 (November 1976), pp. 929–937; V. Smil, "Intermediate Energy Technology in China," The Bulletin of the Atomic Scientists, Vol. 33, No. 2 (February 1977), pp. 25–31.

Small Coal Mines

Since they started to recover from the post-Great Leap slump in the early 1960's, small coal mines, financed and operated by administrative regions, counties, communes, and production brigades, have been steadily gaining in importance and now they produce one-third of China's raw coal,[27] a higher share than at the height of the 1958 native pits campaign (for annual output figures see appendix C). Most of the new small mine capacity has been added since 1969 and located in the coal-deficient southern half of the country to reduce the area's traditional dependence on the imported northern coal. Every province and region south of Yangtze, and also Tibet, has a large number of permanent or seasonal small mines which have been instrumental in increasing the area's coal self-sufficiency to more than 70 percent in 1976.[28] Small and medium size coal mines are also very important in some northern provinces: In Shansi, the nation's leading coal producer, these enterprises provide more than 40 percent of total production, enough to cover all basic local needs and to free the higher quality large mine output for shipment to coal-deficient provinces.[29]

Total number of small mines is now around 100,000, with a typical output of about 1,000 tons of coal per year, although the largest enterprises in this category produce as much as 100,000 tons annually.[30] Most of the mines are open pits established in less than a year on suitable outcrops, or single shallow shafts located at deposits too small to be developed by mechanized mining. Human and animal labor dominates the extraction and distribution of the low-quality fuel which is used, without any sorting or preparation, either as household fuel or as the primary heat source—or raw material—in local small industries. Lifespan of many small mines relying solely on traditional technology is often very short, labor productivity is dismal, and safety conditions are apalling. All of these considerations have led the Chinese to embark on a modest program of modernizing the largest small mines and expanding their capacity to maintain their important role in the national coal production.

Small Hydropower Stations

Mass construction of small hydro stations started during the "Great Leap" years, was abandoned during the early 1960's and has been successfully revived after 1969. Dependence on local resources, maximum thrift and construction speed have been the main characteristics of the program. Stations are built predominantly with locally accumulated funds with central investment used only for occasional design, equipment manufacturing or operator training assistance. Massed labor, equipped with traditional tools (chisels, picks, shovels, shoulder-poles and carrying baskets, wheelbarrows and pull carts) is used in almost all instances, and the dams are either rock-filled or earth-filled structures, requiring only a minimum of cement, steel, and timber. Many counties are now equipped to produce their own small water turbines (ranging from primitive wooden devices to modern Pelton, Francis, and Nagler propellers) and generators,[31] transformers, cement poles, wire and switches, and can also train the needed operators.

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[27] Pien Hui, "The Role of China's Medium and Small Industries," China Reconstructs, Vol. 26, No. 7 (July 1977), p. 19.

[28] New China News Agency (NCNA) in English, SWB, FE/W910/A/6 (5 January 1977). Available figures show that the shares of small mine output in the total raw coal production equal 80 in Chekiang, over 60 in Hunan and Fukien, more than 50 in Yunnan and over 40 in Kiangsu and Kweichow: NCNA and provincial broadcasts, SWB, FE/W799/A/13–15 (27 November 1974); FE/W860/A/6–9 (14 January 1976); FE/W945/A/10 (7 September 1977) and Joint Publications Research Service (JPRS), No. 69661 (Aug. 23, 1977), p. 16.

[29] NCNA claimed that Shansi's small mines fulfilled their 1977 plan 91 days ahead, producing 24 mmt of raw coal by October 1: NCNA in English, SWB, FE/W952/A/13 (October 26, 1977).

[30] CIA, "China: The Coal Industry" (Washington, D.C., CIA, 1976), pp. 8–9.

More than 70,000 stations are now operating throughout China but naturally, the rainy provinces south of the Yangtze account for most of the total—approximately four-fifths—and Kwangtung alone has almost 20 percent of all small hydroplants. The typical installed capacity of a station is very small indeed: Available provincial figures result in the weighted average of about 45 kilowatts per hydro station. Prefecture and country figures, collected for some 10,500 stations during 1972–77, indicate better the highly skewed size distribution and significant local variations: Most stations are very small (less than 25 kilowatts per station) and higher averages are rather meaningless due to the inclusion of a few larger medium-sized plants in the totals.[32] Extreme turbogenerator sizes range from miniature devices (0.4–12 kilowatts capacity) produced by the Tientsin Electro-Driving Research Institute to tap spring and creek waters to units in excess of 1,000 kilowatts.

The total generating capacity of small and medium-size hydroplants rose sharply from 500 megawatts in 1969 to nearly 3,000 megawatts in 1975.[33] As might be expected, the load factor of small stations is considerably lower than the average for large installations: available figures translate into the mean time of 2,726.5 hours per kilowatt per year (load factor 31 percent) in Kwangtung and 2,000 hours per kilowatt annually in Chekiang and Honan (load factor of merely 22.8 percent), with some county averages as low as 1,250 hours; [34] nevertheless, the small stations accounted for one-third of total hydro generation—or about 10 billion kilowatt hours—in 1975, contributing considerably to the rudimentary electrification of the Chinese countryside. Besides providing power for local small industries, as well as irrigation and drainage, food and fodder processing and timber sawing, small hydro reservoirs regulate water supplies, help prevent floods, and are used to breed fish and other aquatic products. This multipurpose nature of small hydro projects seems to be the best proof of their utility and the best assurance of their continuous development.

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[31] Chinese are also offering small compact hydrogenerating sets with power ratings between 0.418–28 kilowatts for export; they are suitable as power sources for lighting, broadcasting, and grain milling and the sets larger than 3 kilowatts can be also directly coupled to working machinery by means of the pulley on the generator shaft. The generators are sold through China National Machinery Import and Export Corp. and are regularly displayed at the Canton Trade Fair.

[32] Tung County in Kwangsi offers an excellent illustration: As of July 1977 it had 238 stations with 10,773 kilowatts, that is, almost exactly the nationwide average of 45 kilowatts per station; however, four county-run stations had 5,760 kilowatts (average 1,440 kilowatts, while eight commune-run plants had an average 175.5 kilowatts per station and 226 stations run by production brigades and teams had 3,609 kilowatts for an average of merely 15.96 kilowatts: NCNA in Chinese, SWB, FE/W937/A/10 July 13, 1977).

[33] CIA, "China: Economic Indicators," op. cit., p. 13.

[34] NCNA in Chinese and provincial broadcasts, *SWB*, FE/W881/A/7 (June 9, 1976); FE/W913/A/8 (Jan. 26, 1977); FE/W949/A/11) Oct. 5, 1977).

Biogas Generation

Biogas (the Chinese use the term marsh gas) is a mixture of roughly two-thirds methane, one-third carbon dioxide and traces of hydrogen sulfide, hydrogen and nitrogen, which can be produced in sealed, insulated containers, by the controlled anaerobic fermentation of animal and human excrements, vegetation pieces (grasses, leaves, crop residues), household garbage, organic industrial waste (sugarmaking and oil-pressing residues) and waste water. Mass production of biogas in China is only of recent origins—yet the Chinese can already claim the world leadership in this relatively simple but immensely useful energy technology.[35] Construction of biogas digesters—typically 5–10 m³ airtight concrete, brick, or rock containers buried in the ground and consisting of loading, fermentation and slag compartments (fig. 2)—originated on a large scale in Szechwan Basin in the early 1970's and by mid-1977 the nationwide total of fermenters of different capacities, ranging from a few m³ to communal tanks of 100 m³, reached nearly 4.5 million.

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[35] For details on the Chinese biogas generation see V. Smil, "China Claims Lead in Biogas Energy Supply," Energy International, vol. 14, No. 6 (June 1977), pp. 25–27 and V. Smil, "Energy Solution in China," Environment, vol. 19, No. 7 (October 1977), pp. 27–31. Georges Chan of the South Pacific Commission (Noumea, New Caledonia) was able to obtain a copy of a very informative 134 page booklet on building and operating biogas digesters which was prepared by Szechwan province's leading group in charge of popularizing methane gas in 1975: Its translation, with detailed technical commentary, is now being prepared at the University of Manitoba and should be available in late 1978 or early 1979. Currently the best general description of technical aspects and practical applications of biogas production can be found in: Board of Science and Technology for International Development, "Methane Generation from Human, Animal and Agricultural Wastes" (Washington, D.C., National Academy of Sciences, 1977).

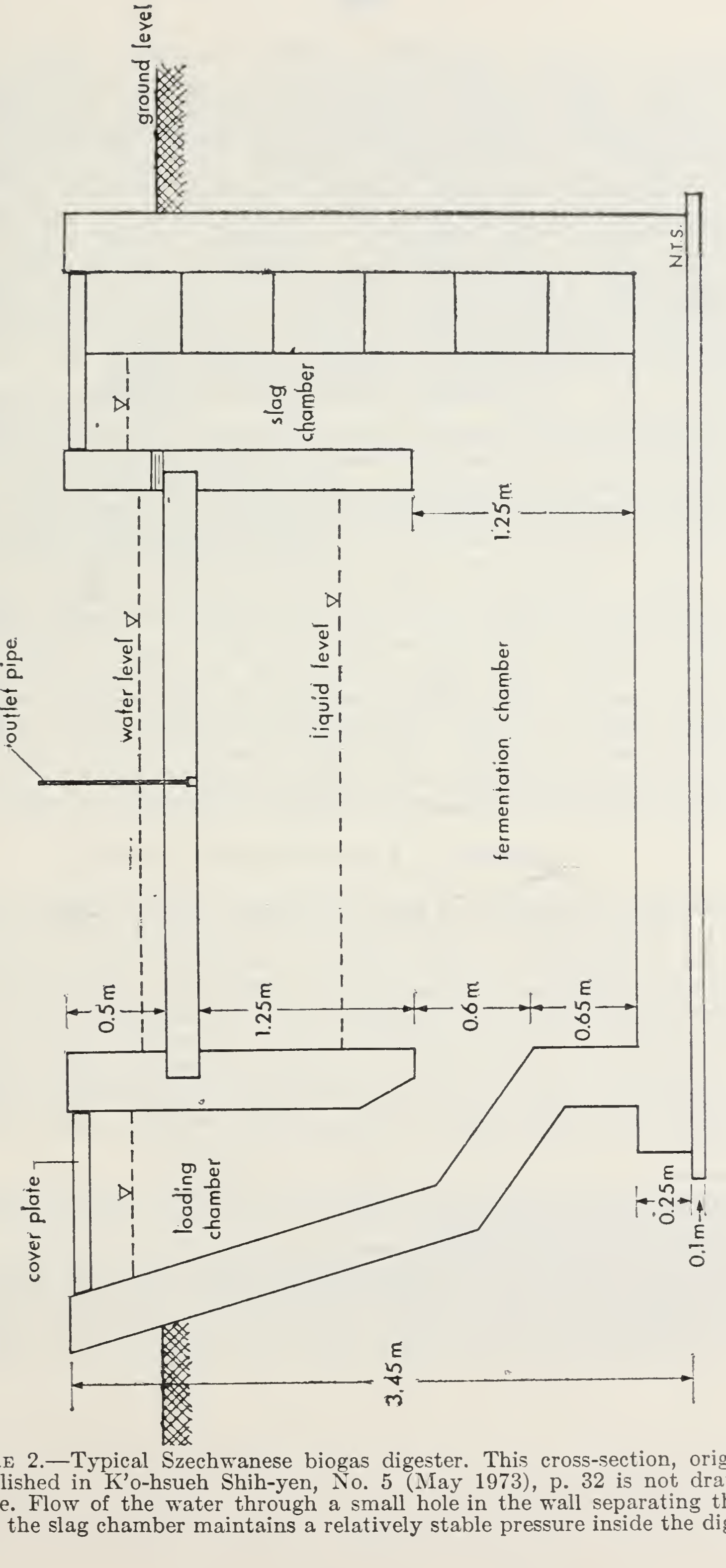
ground level
N.T.S.
slag chamber
outlet pipe
water level
liquid level
fermentation chamber
1.25m
0.5m
1.25m
0.6m
0.65m
cover plate
loading chamber
0.25m
0.1m
3.45m

FIGURE 2.—Typical Szechwanese biogas digester. This cross-section, originally published in K'o-hsueh Shih-yen, No. 5 (May 1973), p. 32 is not drawn to scale. Flow of the water through a small hole in the wall separating the gas and the slag chamber maintains a relatively stable pressure inside the digester.

Digesters are not expensive to build (available figures from Szechwan and Hunan quote 30–40 yuan for a typical 10 m^3 tank with the smallest units costing as little as 10 yuan) but their efficient operation demands careful attention to several environmental factors. Proper liquidity of the load, approximately 25:1 carbon-to-nitrogen ratio of digestible materials, neutral or slightly alkaline (pH 7–8) fermenting fluid, tank temperature between 28–45° C and regular addition, removal, and mixing of ingredients are all essential for maintaining the sustained high yield of biogas. However, when properly managed, a typical 10 m^3 digester running on pig manure, human waste, and crop residues or grasses will provide all the energy needed for both cooking and lighting during summer and autumn months for a southern Chinese commune family of five.

Biogas is not suitable only for household cooking (the process is faster, easier, and less expensive than with wood or straw) and lighting (a gas lamp brighter than a 100-watt incandescent bulb can be used) but it can also generate electricity and power water pumps and crop processing machinery. Moreover, the benefits go beyond the availability of a clean and versatile fuel: Savings of fossil fuels and reduction of fuel expenditures offer a significant economic advantage; conservation of forests and grasses has favorable ecological implications; elimination of many insect pests and diseases markedly improves hygienic conditions of rural areas;[36] burning of biogas largely eliminates the tedious, every day gathering of firewood or grasses and lightens household labor; finally, methanogenic fermentation yields an excellent organic fertilizer, an essential ingredient of the Chinese farming. Even in relatively cold Honan, where fermentation efficiencies are lower than in the south, sludge removed from each 10 m^3 digester provides annually an equivalent of 30 kilograms of ammonia.[37]

LARGE-SCALE FOSSIL FUEL PRODUCTION

Although the reliance on local small-scale energy production has been a crucial element in rudimentary rural modernization, it cannot ever be considered a viable basis for advanced industrialization which requires large and steady flows of fossil fuels and electricity.[38] Chinese achievements in providing these requirements have been fairly substantial—both in absolute terms (see annual output figures in appendix C) and in relative international comparisons—but new major advances will be needed to satisfy the greatly expanded demands of agricultural mechanization, industrial and defense modernization as well as to raise the living standard of population.

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[36] Anaerobic fermentation destroys 50 percent of Escherichia coli in 3 months and 95 percent of Schistosoma japonicum (blood fluke) eggs are eventually destroyed in the process, a fact of high importance for still large schistosomiasis areas of southern China.

[37] Chung-kuo Hsin-wen (Aug. 13, 1977), p. 5; translated in JPRS, No. 70016 (Oct. 21, 1977), p. 4.

[38] The problems with small coal mines have been already mentioned: low quality of fuel, making it unsuitable for modern efficient enterprises, low productivity, and poor safety. Many mines are also only short-lived and seasonally operated and cannot be relied on supplying steady base requirements. The same is true about many small hydro stations with their very low load factors, erratic service and silting-up reservoirs. Biogas digesters cannot be used in colder regions of the and country even in temperate and warm provinces their efficiency, and hence their gas output, drops sharply during the winter months.

Coal Industry

China's raw coal output is now exceeding half a billion tons a year, the total surpassed only by the Soviet and the U.S. production.[39] Coal is still the country's principal fuel and large northern and northeastern mines (figure 3) remain its biggest suppliers. Collieries of Ta-t'ung, Fu-hsin, Fu-shun, Ho-kang, Chi-hsi, and P'ing-ting-shan each extract over 10 mmt of raw coal annually, and K'ai-luan, China's oldest and largest commercial mine concentration, surpassed alone 25 mmt in 1975 before it was devastated by the July 1976 earthquake.[40] The best available provincial estimates indicate that the North and the Northeast produced no less than 60 percent of the national output and that the South, with no more than 17 percent of the production, remains an uncomfortably coal-deficient region.[41]

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[39] The 1975 U.S. coal output reached 586.43 mmt (USBC, op. cit., p. 710); the Soviet production was the world's largest with 701.28 mmt (Tsentralnoye statisticheskoie upravlenie (TsSU), "Narodnoe khozyaistvo SSSR v 1975 g." (Moscow, Statistika, 1976), p. 242.

[40] For details on K'ai-luan's development, production, and national importance see V. Smil, "Earthquake Strikes at China's Energy Centres," Energy International, vol. 13, No. 12 (December 1976), pp. 21–22 and H. Harnisch and H. G. Gloria, "Eindrucke vom chinesischen Steinkohlenbergbau im Kailaner Revier," Gluckauf, vol. 111, No. 21 (Nov. 6, 1975), p. 1010.

[41] CIA, "China: The Coal Industry," op. cit., p. 8.

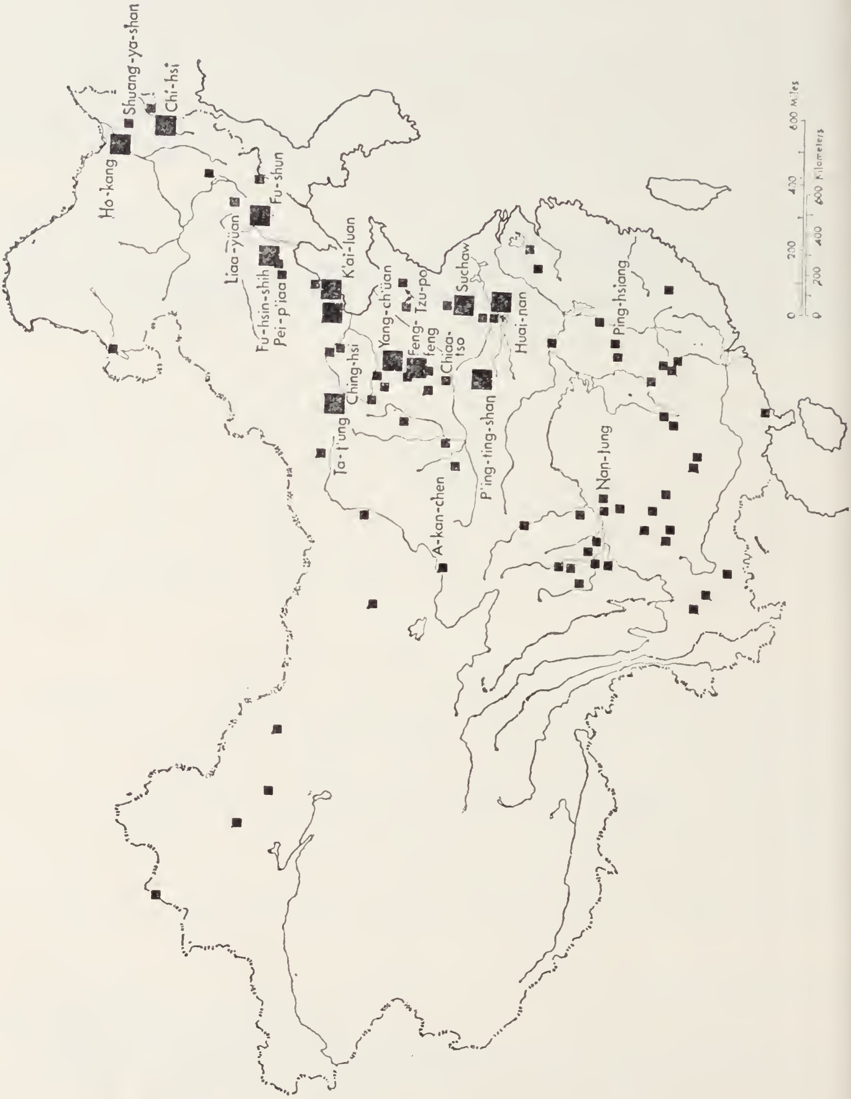
Ho-kang
Shuang-ya-shan
Chi-hsi
Fu-shun
Liao-yüan
Fu-hsin-shih
Pei-p'iao
K'ai-luan
Ching-hsi
Ta-t'ung
Yang-ch'üan
Feng-feng
Tzu-po
Chiao-tso
A-kan-chen
Suchow
Huai-nan
P'ing-ting-shan
Nan-t'ung
Ping-hsiang
0 200 400 600 Miles
0 200 400 600 Kilometers

FIGURE 3.—China's major coalfields. Large squares show collieries with more than 10 mmt of annual raw coal production in the mid-1970's.

There are other similarly intractable problems in China's coal industries. Investment in new mines has been clearly inadequate during this decade with most of the output increases coming from existing collieries. For example, before the earthquake five of the seven K'ai-luan's mines were producing twice as much as was their designed capacity [42] and similar indications of intensive exploitation of old mines are available for other coalfields around the country. Mechanization of large mines remains low and although there are some fairly advanced collieries, no more than 50 percent of all Chinese coal is extracted, loaded, and conveyed mechanically, whereas these operations are virtually 100 percent mechanized in the two other coal superpowers. Even more serious is the shortage of coal preparation capacity; the latest reliable account found its total at 83.62 mmt in 1970 [43] and if it would have since grown even by sustained 10 percent per year—certainly a too optimistic assumption—the 1977 total could not be greater than about 150 mmt, that is no more than one-third of the country's total raw coal production.[44] And the share of the most efficient and most progressive method of extraction—large-scale surface mining—is even lower, perhaps no more than 10 percent.[45]

These problems are certainly well recognized, and the Chinese have tried to move toward their solution by reestablishing a separate Ministry of Coal Industry in January 1975 and by embarking on a 10-year plan of comprehensive modernization in October of the same year. The major tasks announced were the general mechanization (80–85 percent of all operations) of principal large mines, concentration of the future developments in the existing major coalfields and in new large mines currently under construction as well as the continuing expansion of small mines. As part of this program, more than 50 new shafts were completed in 1976 and 21 pairs of new shafts, with an annual capacity of five mmt, went into operation between January and mid-September 1977.[46] K'ai-luan attained its pre-earthquake output by the end of 1977, greater variety of coal machinery is available from domestic production and sizable production increases are expected in the South.[47]

Nevertheless, it will be a difficult and costly effort to modernize the industry and to maintain its historical output exponential growth of 5.4 percent annually[48] in the decade ahead as the need for heavy investment in this relatively neglected—yet still absolutely essential—field will have to be weighed against, and adjusted to, the no less pressing requirements of other branches of modern energetics.

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[42] Hopeh provincial broadcast, SWB, FE/W810/A/11–12 (Jan. 22, 1975).

[43] A. B. Ikonnikov, "The Capacity of China's Coal Industry," Current Scene, vol. 11, No. 4 (April 1973), p. 8.

[44] Coal preparation involves removal of the associated rocks (crushing, washing, and gravity separation of coal and foreign material followed sometimes by dewatering of smaller sizes) and production of fractions of uniform size and quality for different markets. Unprepared coal cannot be used in large modern boilers which can convert the fuel into heat as much as four or five times more efficiently than household stoves or small boilers burning raw coal.

[45] U.S. surface production was 54.7 percent in 1975 and, in the same year, the Soviet open mines produced 32.2 percent of the total: USBC, op. cit., p. 710; TsSu, op. cit., p. 242.

[46] NCNA in English, *SWB*, FE/W950/A/15 (October 12, 1977); NCNA also claimed that all equipment for these shafts, including hoisting machines, electrical control devices, excavators and scraper conveyors, was domestically designed and produced.

[47] Hunan's goal is more than 25 million tons of raw coal in 1980, Fukien plans for self-sufficiency at the same time: Hunan and Fukien provincial broadcasts, *SWB*, FE/W952/A/13 (October 26, 1977); FE/W941/A/13 August 10, 1977).

[48] When the production depressions caused by the Sino-Japanese civil war and Cultural Revolution, as well as the Great Leap surge, are left out, the Chinese coal output for the past 60 years shows an excellent exponential fit with a growth rate of about 5.4 percent annually: V. Smil, "China's Energy," op. cit., p. 23.

Hydrocarbon Industries

Very high growth rates of China's hydrocarbon extraction, first crude oil exports to Japan and other East Asian countries, expansion of oilfields and refineries, new major gas discoveries and the promising offshore potential have brought widespread international attention to China's oil and gas industry[49]—as well as numerous predictions of the country's emergence as a Saudi Arabia of the Far East.[50] Admittedly, the country's annual crude oil production increments have been quite substantial—though not without many precedents around the world—during the first half of this decade, but critical analyses had to conclude that China's future export potential is limited, and that the fast growth rates are unsustainable.[51] Recent developments have confirmed these conclusions[52] and there is little doubt that the Chinese hydrocarbon production will require large investments and far reaching technological modernization just to keep up the pace with the growing demand.

This is due to a multitude of deficiencies which have accompanied the Chinese oil and gas development. The technology has been very much Soviet-oriented and the Chinese problems are similar to the Soviet ones, only more widespread: shortage of sophisticated geophysical equipment (modern seismic devices, computerized field units) limits the capability of locating deep structures; inefficiencies in field operations are caused by shortages of high quality drilling and casing pipes, continuing reliance on old turbo-drills, poor drill bits and mud pumps, lack of gas treating facilities, and until recently, the prevalent use of line-drive waterflooding.[53] This all spells low ultimate recovery rates and slow pace of development in any but rich and shallow fields.[54] The Chinese offshore drilling and production technology is especially rudimentary: their drilling fleet for 1976–77 consisted of only two shallow-water barges, two shallow-water jackup rigs, one older jackup and its near copy and two catamaran drillships.[55]

In spite of several major additions during the past 5 years, pipeline network is still quite thin, totaling about 7,500 km.[56] Similarly, major improvements have also been achieved in the Chinese oil ports but Lü-ta in Liaoning is still the only installation able to accommodate 100,000-ton tankers and there are only two other terminals—Chan-chiang in Kwangtung and Huang-tao in Shantung—which can handle 70,000-ton vessels.[57] However, the largest domestically-built tankers have only 25,000 tons and the Chinese will have to build or import bigger ships to take the advantage of significant economics of scale which they could enjoy by using larger vessels for their north-south coastal shipments of crude oil.[58] With the increasing consumption of oil products in large southern cities, as well as in the countryside, these shipments are bound to increase substantially because the regional disparity in crude oil production is even stronger than in the case of coal extraction. Five giant oilfields in the Northeast and the north are producing nearly 90 percent of the nation's oil (figure 4), an imbalance which cannot be remedied easily.

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[49] The most valuable publications have been B. A. Williams, "The Chinese Petroleum Industry: Growth and Prospects" in "China: A Reassessment of the Economy," op. cit., pp. 225–263; H. C. Ling, "The Petroleum Industry of the People's Republic of China" (Stanford, Hoover Institution, 1975): Chu-yuan Cheng, "China's Petroleum Industry" (New York, Praeger Publishers, 1976) and CIA, "China: Oil Production Prospects" (Washington, D.C., CIA, 1977).

[50] Chairman of the Japan-China Oil Import Council, Ryutaro Hasegawa, and the Japan External Trade Organization were the principal sources of these predictions and their unfounded statements have been, unfortunately, transmitted to the American readers under sensational headings by S. S. Harrison, "Time Bomb in East Asia", Foreign Policy, No. 20 (Fall 1975), pp. 3–27 and Choon-ho Park and J. A. Cohen, "The Politics of China's Oil Weapon", ibid. pp. 28-40.

[51] See, among others, V. Smil. "Communist China's Oil Exports: A Critical Evaluation", Issues and Studies, vol. 11, no. 3 (March 1975), pp. 71–78: CIA. "China: Energy Balance Projections" (Washington, D.C., CIA, 1975): R. W. Hardy, "Chinese Oil" (Washington, D.C., The Center for Strategic and International Studies, 1976).

[52] Crude oil production growth rate dropped from 20 percent in 1974 to 13 percent in 1975, stayed at the same level in 1976 and dropped further to only eight percent for the first 11 months of 1977 according to "Initial Success in Economic Construction," Peking Review, Vol. 21, No. 2 (January 13, 1978), p. 12.

[53] A. A. Meyerhoff and J-O. Willums, "Petroleum Geology and Industry of the People's Republic of China", CCOP Technical Bulletin, Vol. 10 (1976), pp. 204–205.

[54] CIA, "China: Oil Production Prospects," op. cit., p. 22.

[55] Meyerhoff and Willums, op. cit., p. 206.

[56] Meyerhoff and Willums, op. cit., p. 207; for details on oil pipelines, both in operation and under construction, see CIA, "China: Oil Production Prospects," op. cit., p. 25.

[57] CIA, "China: Oil Production Prospects," op. cit., p. 26.

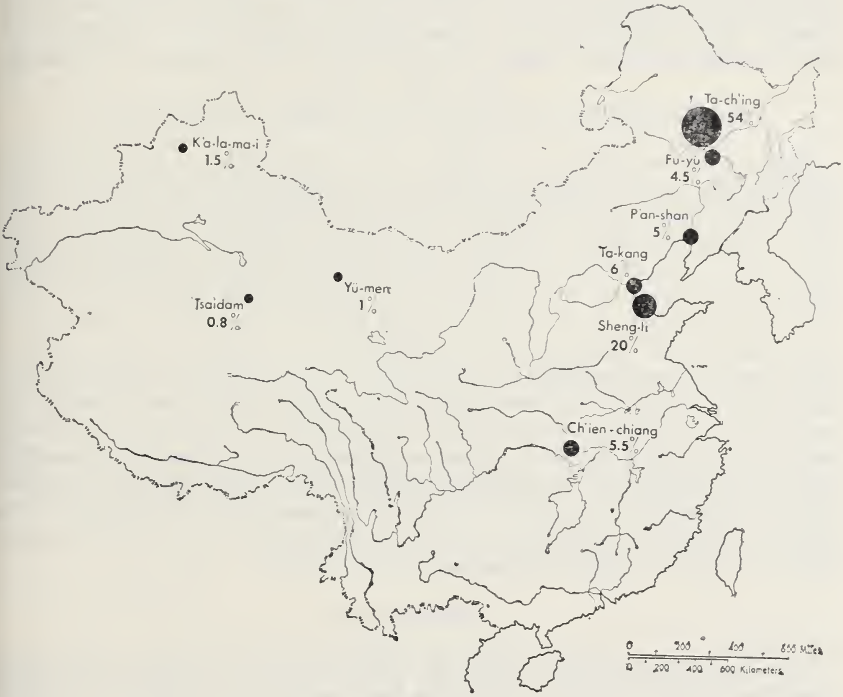

FIGURE 4.—China's major oilfields. Shares of the 1975 crude oil production (according to the CIA, "Economic Indicators," op. cit., pp. 28–29) are shown for nine major fields which provided 98.3 percent of the aggregate output of 74.261 mmt.

Yet another serious deficiency affecting China's oil industry has been the persistent shortage of refining capacity. According to the official claims, crude oil output had grown more than six times between 1965 and 1974, but the refining capacity increased less than four times, and only a slightly smaller disparity between the two volumes was reported during 1977.[59] Even after subtracting the exports and the crude oil burned directly in power plants, the difference between the production and refining estimates suggests that China must be stockpiling large amounts of crude oil.[60]

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[58] The Japanese and European experience has shown that the largest economies of scale are realized when increasing the tanker size between 20,000 and 200,000 deadweight tons; gains are much smaller for larger ships—while the problems with them (maneuverability, accident and pollution chances) are greater. The Chinese have actually bought several secondhand 75,000–100,000-ton ships from Japan and Europe.

[59] NCNA claimed that while the crude oil output during the first half of 1977 was 10.6 percent higher than during the comparable period in 1976, the amount of oil refined was up by only 8 percent: NCNA in English, SWB, FE/W938/A/11 (July 20, 1977).

Unfortunately, much less is known about China's increasingly important natural gas industry; it has been predominantly concentrated in Szechwan Basin, but Po Hai fields and the newly opened Ta-ch'ing zone will undoubtedly become more prominent with further large-scale expansion of the nitrogen fertilizer industry and even more so in the case of eventual exports of liquefied natural gas to Japan.[61]

Future developments in fossil fuel energetics, as well as those in hydrogeneration, will be, of course, critically influenced not only by investment priorities and technological capabilities: magnitudes, quality, and location of energy resources will be the essential variables.

FOSSIL FUELS AND RENEWABLE ENERGY RESOURCES

China has been always credited with abundant coal resources—some of which have been exploited in a modern commercial way since the 1870's—and, at least since the early decades of this century, with sizable oil shale deposits. Liquid crude oil and natural gas resources were considered rather insignificant for such a large country. Extensive geological and geophysical prospecting carried out after the establishment of the PRC in 1949 has considerably increased the magnitude of all fuel resource categories and affirmed the country's third—and conceivably second—place on the list of global fossil energy endowments. Moreover, large quantities of fissionable materials have also been discovered.[62] Solar energy converted by green plants has been sustaining the Chinese civilization for millenia but among its many important forms only the hydro potential has been systematically appraised, while the direct radiation, wind and thermal sea power—as well as geothermal and tidal energy—have just become a target of interest and preliminary evaluation.

Solid Fuels

The first nationwide totals of coal deposits in China (excluding Manchuria), presented at the 12th International Geological Congress in 1913, spanned a very wide range—the resources estimated were at least 38.765 bmt and as much as 996.613 bmt.[63] Reserve figures claimed by the Nationalist Government in the 1930's and 1940's were between 250 to 300 bmt and rose after several years of Communist exploration to 1,000 to 1,500 bmt in the mid-1950's.[64] Total potential resources up to 1,800-m depth were placed during the Great Leap period (in 1958) at 9,000 bmt,[65] undoubtedly a very generous estimate as the proved reserves at the end of 1958 were put by an official publication just in excess of 80 bmt.[66]

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[60] Although other analysts also believe that the Chinese refining capacity is inadequate (see, for example, Chu-yuan Cheng, op. cit., pp. 88–98), CIA estimates would have the Chinese refineries working only at 87 percent of their capacity in 1975 (CIA, "China: Oil Production Prospects," op. cit., p. 26)—and hence to be fully capable to process the whole domestic consumption.

[61] This project, involving initially a liquefying plant for Ta-kang gas with annual capacity of 300,000 tons per year, was first discussed in 1975: Kyodo in English. SWB. FE/W853/A/19 (Nov. 19, 1975).

[62] Communist Chinese have never released any figures on the resources of fissionable materials; Western estimates credit the PRC with 20,000 to 100,000 tons of uranium (World Energy Conference (WEC), "Survey of Energy Resources 1974" (London. WEC, 1974), p. 205). Considering that the reasonably assured U.S. resources at up to $26 per kg of uranium were at least 330,000 tons in 1974 (WEC, loc. cit.), the estimates for China would seem to be rather low. In any case, China has enough fissionable materials to support not only her nuclear armaments but also to develop an independent nuclear power industry.

[63] N. F. Drake and K. Inouye, "The Coal Resources of China" in W. McInnes, D. B. Dowling, and W. W. Leach, eds., "The Coal Resources of the World" (Toronto. Morang. 1913), pp. 165 and 173.

[64] Yuan-li Wu with H. C. Ling, "Economic Development and the Use of Energy Resources in Communist China" (New York, F. A. Praeger, 1963), p. 35.

No new nationwide figures have been released since then, and all foreign observers are left to juggle these 20-year-old totals. Soviet experts, who worked extensively in China, accept the highest totals—1,500 bmt for reserves and 9,000 bmt for resources.[67] World Energy Conference uses 80 bmt for "recoverable reserves" and 1,000 bmt for "total resources in place," [68] and an experienced analyst of the Chinese mining industries preferred recently to quote no values whatsoever.[69] Perhaps the best current interpretation of the Chinese coal resource figures is that the recoverable reserves are no less than 100 bmt and the total resources are at least 1,500 bmt.[70]

Different resource estimates are in an excellent agreement as far as the fuel categories are concerned. Bituminous coals account for four-fifths of the total, anthracites for slightly less than one-fifth, and lignites for only a few percent.[71] Quality of coal is mostly very good and seams are of above average thickness and are predominantly horizontal or only slightly inclined.[72] In sum, China's coal resources are outstanding both in their quantity and quality.

Hydrocarbons

During the 1920's the Standard Oil Co. estimated crude oil resources in Shensi, Kansu, Sinkiang, and Szechwan at 188 mmt;[73] in 1935, the Chinese Bureau of Mines put the total for hydrocarbon liquids at 620 mmt (including oil potentially extractable from Fu-shun and Shensi shales).[74] The highest Kuomintang estimate was about 780 mmt, and the post-1949 exploration increased this total to 2.75 bmt in 1953 and to 5.9 bmt in 1959.[75] Two-thirds of this latest official resource figure were in shale oils, and only 200 mmt belonged to the measured reserve category.

Continuing absence of authoritative Chinese oil resource figures is, of course, much more unfortunate than the lack of updated coal resource estimates: coal deposits are much easier to discover and to quantify than are the hydrocarbons, and it is highly unlikely that the solid fuel totals underwent any drastic change; on the other hand, China's largest producing oilfields were discovered only after the latest official estimate was released and, consequently, even the best outside estimates are hardly more than educated guesses.[76]

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[65] Wu, loc. cit.

[66] State Statistical Bureau, "Ten Great Years" (Peking, Foreign Languages Press, 1960), p. 14.

[67] I. I. Bazhenov, I. A. Leonenko, A. K. Kharchenko, "Ugolnaya promyshlennost Kitaiskoi Narodnoi Respubliki" (Moscow, Gosgortekhizdat, 1959), p. 44.

[68] WEC, op. cit., p. 74

[69] K. P. Wang, "The PRC: A New Industrial Power With a Strong Mineral Base" (Washington, D.C., USGPO, 1975), p. 17.

[70] For comparison, the U.S. recoverable coal reserves are about 180 bmt and total resources about 2,900 bmt: WEC, op. cit., p. 78.

[71] Wu, op. cit., p. 38; Bazhenov, Leonenko, Kharchenko, op.cit., p. 43.

[72] Bazhenov, Leonenko, Kharchenko, op. cit., pp. 41–44.

[73] Bureau of Mines, National Government of China, in "Transactions Third World Power Conference" (Washington, D.C., World Power Conference, 1936), vol. III, p. 352.

[74] Wu, op. cit., p. 177.

[75] Wu, loc. cit.

[76] It must be pointed out that estimates of recoverable oil and gas resources are very contentious even in the case of the world's most extensively explored area—the United States. For details on varying totals and interpretations see, among many others, T. M. McCulloh, "Oil and Gas" in D. A. Brobst and W. P. Pratt, eds., "United States Mineral Resources" (Washington, D.C., USGPO, 1973), pp. 477–496; and J. P. Riva, Jr., and H. T. Franssen, "Energy Supply: Oil and Natural Gas" in "Project Interdependence," op. cit., pp. 130–207.

Review of estimates published in the 1970's (table 5) shows an extremely large range of values (due above all to the near total lack of any hard knowledge about offshore resources and to a rather liberal treatment of oil shales); nonuniform categorization of resources also precludes direct comparisons.

TABLE 5.—ESTIMATES OF CHINA'S CRUDE OIL RESERVES

Estimator	Year	Total amount (billion metric tons)	Reserve category
Meyerhoff [1]	1970	0.78	Total probable ultimate recovery from known fields.
		.96	Minimum estimate of proved and probable reserves.
		1.72	Minimum estimate of potential reserves.
		2.68	Total proved and probable and potential reserves.
Chen [2]	1971	10.00	Total reserves.
Kambara [3]	1973	1.20-1.80	Proved and probable reserves.
Koide [4]	1973	3.00-10.00	Reserves.
World Energy Conference [5]	1974	1.73	Proved recoverable reserves.
		5.00	Estimated recoverable reserves from estimated total reserves.
		21.00	Estimated recoverable oil from shales.
National Council for United States-China Trade [6].	1974	6.00-10.00	Onshore reserves.
		20.00	Potential offshore reserves.
Willums [7]	1975	5.5-8.9	Total ultimately recoverable onshore reserves.
		4.1-8.51	Total ultimately recoverable offshore reserves.
		10.3	Total ultimately recoverable reserves.
Williams [8]	1975	1.116	Proved reserves.
		5.9	Proved and probable reserves.
		7.6	Total proved, probable, and potential reserves.
Terman [9]	1976	4.1-4.8	Total onshore reserves.
		1.4-2.1	Total offshore reserves.
		5.5-6.9	Total reserves.
Meyerhoff and Willums [10]	1976	5.398	Produced, proved, probable, and potential onshore reserves.
		4.110	Produced, proved, probable, and potential offshore reserves.
		9.507	Total reserves.
Oil & Gas Journal [11]	1977	2.75	Estimated proved reserves.

[1] A. A. Meyerhoff, "Developments in Mainland China, 1949–1968", American Association of Petroleum Geologists Bulletin, vol. 54, No. 8, (August 1970), p. 1573.

[2] Cheng-siang Chen and Kam-nin Au, "The Petroleum Industry of China", Die Erde, Nos. 3–4 (1972), p. 319.

[3] T. Kambara, "The Petroleum Industry in China", China Quarterly, No. 60 (October–December 1974), p. 711.

[4] Y. Koide, "China's Crude Oil Production", Pacific Community, vol. 5, No. 3 (April 1974), p. 464.

[5] WEC, op. cit., pp. 136 and 188.

[6] Cited by L. Auldridge, "Mainland China Striving to Boost Crude Exports", Oil & Gas Journal, vol. 73, No. 1 (Jan. 6, 1975), p. 27.

[7] Jan-Olaf Willums, "China's Offshore Oil: Application of a Framework for Evaluation of Oil and Gas Potentials Under Uncertainty" (Cambridge, Mass., unpublished Ph. D. dissertation, M.I.T., 1975), p. 265.

[8] B. A. Williams, op. cit., p. 235.

[9] M. J. Terman, "Sedimentary Basins of China and Their Petroleum Potential" in SEAPEX Proceedings, vol. III (Singapore, SEAPEX, 1976), p. 127.

[10] Meyerhoff and Willums, op. cit. p. 201.

[11] "Worldwide Oil and Gas at a Glance", Oil & Gas Journal, vol. 75, No. 53 (Dec. 26, 1977), p. 101.

Certainly the most detailed attempt to estimate China's natural crude oil resources has been the field-by-field account of A. A. Meyerhoff who was given access to Soviet geological appraisals in the late 1960's and who has since, in cooperation with Willums, revised his figures.[77] On the other hand, resource appraisals leaked by the Chinese to some visitors from the United States are patently useless.[78] A Chinese official told H. P. Hoose, a Los Angeles lawyer representing U.S. oil equipment companies at the Canton Trade Fair in the spring of 1973, that according to the Chinese evaluations, the PRC is, following the Middle East and North America, the world's third richest oil region.[79] More than a year later Ping-ti Ho, a history professor at the University of Chicago, was told by authoritative sources in Peking that "the size of China's known oil deposits, not counting the unexplored and potentially rich areas of the Yellow Sea and East China Sea, are larger than presently known reserves of the entire Middle East." [80]

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[77] Another detailed study is now being conducted by M. J. Terman of the U.S. Geological Survey. The most significant difference between Meyerhoff's and Terman's interpretation is in their assumptions about tectonic genesis of the offshore basins, particularly those under the East China Sea. Unlike Meyerhoff, Terman believes their oil-bearing strata are analogous to the heterogeneous continental and lacustrine Upper Tertiary facies of the graben of North China, having, possibly, high oil content but a rather low economic recoverability.

[78] The intended aim of these unreasonable claims was, of course, to attract attention by exaggeration, a move that certainly succeeded.

To rank behind North America, the current Chinese proved crude oil reserves would have to be 4.8 bmt at the most—but then they could not rank third in the world because the Soviet reserves are just over 10 bmt, making the U.S.S.R. the second richest oil region globally.[81] Should China's onshore proved reserves outrank the Middle East, the country's reserve/production ratio would be incredibly high—in excess of 500 years—compared to 29.7 years for the world as a whole and 45.9 years for the Middle East[82]—and the Chinese could supremely dominate the world oil market and would have certainly no need to initiate, as they have done, difficult and costly offshore drilling.

Leaving aside the undoubtedly sizable shale oil resources, whose oil content and recoverability are largely unknown, the best currently available geological evidence, compatible with production totals and growth rates, would indicate that China's crude oil reserves are certainly no less than 3 bmt and most likely no more than 10 bmt.[83]

There is even more uncertainty about China's natural gas deposits. Based on the Soviet data, Meyerhoff estimated the Szechwanese reserves at 528.6 bm^3 and Tsaidam reserves at 81.4 bm^3 as of the beginning of 1969 [84]; World Energy Conference 1974 total for proved recoverable reserves was 680 bm^3 [85] and the latest Oil and Gas Journal estimate is 708 bm^3.[86] These estimates are not widely apart, but they are undoubtedly extremely conservative: ultimately recoverable volume has been put by Meyerhoff and Willums one order of magnitude higher—8,571 bm^3 with 5,714 onshore and 2,857 bm^3 offshore.[87] Conservative figures of less than 1,000 bm^3 would not place China's reserves even among the top 15 in the world ranking, while just taking the onshore total around 5,000 bm^3 would elevate the country to fourth place, behind the U.S.S.R., Iran, and the United States.

Renewable Energy Resources

As for any large territory spanning comparable latitude, solar radiation received by China represents a vast potential resource of clean energy—somewhere between 9 to 12×10^{18} kcal annually—whose commercial exploitation faces a multitude of technical and economic problems. The best opportunity for collecting direct radiation is in high-lying, clear and clean mountain plateaus and deserts of Tibet, Tsinghai, Sinkiang, and Inner Mongolia, all sparsely populated and mostly very remote from industrial and agricultural concentrations of the eastern half of the country.[88] Indirect harvesting of solar flow in green plants and hydropower stations will thus remain by far the most important renewable sources of energy in China for decades to come.

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[79] P. Strauss, "China's New Claim", Far Eastern Economic Review, vol. 80 (May 14, 1973), p. 41.

[80] Los Angeles Times (Oct. 13, 1974), pt. VI, p. 1.

[81] "Worldwide Oil at a Glance," op. cit., pp. 100–101.

[82] Ibid.

[83] Values close to the upper limit of this range would make China's crude oil reserves nearly as large as are currently the Soviet ones and just slightly in excess of the Iranian and Kuwaiti totals.

[84] Meyerhoff, op. cit., p. 1579.

[85] WEC, op. cit., p. 111.

[86] "Worldwide Oil and Gas at a Glance," loc. cit.

[87] Meyerhoff and Willums, op. cit., p. 204.

Estimates of net annual productivity of China's vegetation have already been presented and the total for forests should be appreciably enlarged through further afforestation, better choice of species and better management. Hydroenergy resources were known to be huge for decades but the Nationalist Chinese total of 136,761,800 kW of potential power[89] was expanded quite considerably through a Soviet-aided Communist survey of 1,598 rivers with a total length of 226,000 km during the 1950's. The theoretical capacity was estimated to be about 540 GW under conditions of average flows with approximately 300 GW suited for actual industrial exploitation.[90] The latest WEC estimate is 330 GW for the average flow (G_{av}) and 60 GW for the flow available 95 percent of the time (G_{95}), placing China respectively first and second in the world in these two hydraulic resource categories.[91]

Chinese tidal energy potential appears to be relatively small[92] but the still mostly unexplored geothermal resources are undoubtedly very large. Most of China is influenced by the 40 million-year-old—and continuing—collision between Indian and Eurasian land masses,[93] which gave rise to profoundly disarranged geological conditions, diverse landforms, the severest earthquakes—and abundant geothermal phenomena, especially on the Tibetan plateau. Chinese have three tiny geothermal stations,[94] apparently all of them based on inefficient vaporization of hot water, and have recently put into operation the country's first direct steam geothermal station in Yangpaching steam field in Tibet, which was discovered during the interdisciplinary survey of Tsinghai-Tibet plateau by the Peking University geothermal group.[95] While it is impossible to present any quantitative appraisal of the geothermal endowment, it is safe to conclude that should the Chinese eventually decide to develop these resources they have one of the world's richest potentials.

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[88] Consequently, there have been only isolated small-scale applications of solar heat collectors in Tibet. where the largest glass absorber (280 m^2) is used for water heating in Lhasa's public bath: NCNA in English, SWB, FE/W866/A/10 (Feb. 25, 1976). Another form of solar energy is now being harnessed on a miniscale in Inner Mongolia: a 100-W portable wind generator is used by the herdsmen and a 2,000-W unit has been tested: "Kuang-ming Jih-pao" (Aug. 10, 1977), p. 2; English translation in JPRS, No. 69944 (Oct. 11, 1977), p. 44.

[89] Carin, op. cit., p. 36.

[90] Y. I. Berezina, "Toplivno-Energeticheskaya Baza Kitaiskoi Narodnoi Respubliki" (Moscow, IVL, 1959). p. 58.

[91] China's 330 GW for G_{av} represent 13.5 percent of the global total; USSR's share is 11.1 percent, U.S. share 7.2 percent and Zaire's 6.7; however, Zaire can utilize its waters most of the time: its G_{95} resources are 77.6 GW, followed by China, USSR and Brazil: WEC, op. cit., p. 173.

[92] R. Carin, "Power Industry in Communist China" (Hong Kong, Union Research Institute, 1969), p. 40 cites at heroretical estimate of 35 GW for the whole country and annual generation potential of 20 bkWh for Ch'ien-t'ang estuary (Chekiang), the most suitable location for an eventual development; a 7,000 MW project for the estuary is believed to be under study by the Chinese planners but because of the exorbitant cost and technical difficulties, construction of a large tidal plant in China is extremely unlikely during this century. However, some small hydro stations in Kwangtung (and also in Shantung) tap the tidal differences of 0.4–1 meter (J. W. Daily, "Hydropower: A Mirror of Self-Reliance", Mechanical Engineering, Vol. 97, No. 5 (May 1975). p. 32).

[93] P. Molnar and P. Tapponier, "The Collision Between India and Eurasia", Scientific American, Vol. 236, No. 4 (April 1977), pp. 30–41.

[94] The first Chinese experimental geothermal power station was put into operation in Feng-shun county in Kwangtung during the year 1970. After degassing, hot water (103.5°C at the bottom of 800.81 m deep well, 91°C at the opening) is introduced into expansion container to produce low-pressure steam and to drive 86 kW turbogenerator ("An Experimental Geothermal Power Station", K'o-hsueh Shih-yen, No. 6 1971), pp. 36–37; English translation in JPRS, No. 60673 (3 December 1973, pp. 1–7). Second small station is in Huai-lai county, 90 km north-west of the capital ("Geothermal Power Station", Peking Review. Vol. 17, No. 20 (May 17, 1974), p. 31) and the third one, with 300 KW set, was built between 1973 and 1975 at Hui-chang spa in Ning-hsiang county in Hunan: Hunan provincial broadcast, SWB, FE/W886/A/7 (14 July 1976).

[95] Ko Tze-yuan, "Tibet's Abundant Geothermal Resources", Ta Kung Pao (8 April 1976), p. 13; Chang Ming-tao, "Tibet's Geysers", China Reconstructs, Vol. 26, No. 11 (November 1977), pp. 44–46.

Regional Distribution of Resources

Sufficient magnitude of the resources is far from being a guarantee of a smooth development in a country so large, so relatively poor and so unevenly settled and accessible as China: spatial distribution is of critical importance and while it is impossible to offer a reliable provincial breakdown the available regional estimates for coal, crude oil and hydroenergy (table 6) are a good indicator of fortunes and problems with China's distributions of major energy resources.

TABLE 6.—REGIONAL DISTRIBUTION OF CHINA'S ENERGY RESOURCES

	Coal [1]				Crude oil reserves [2]				Hydroenergy potential [3]	
	Reserves		Resources		Produced, proved, probable		Total ultimate			
	Billion metric tons	Percent	Billion metric tons	Percent	Million metric tons	Percent	Million metric tons	Percent	Gigawatts	Percent
Total	1,500.0	100.0	9,000	100.0	1,620.1	100.0	5,398.0	100.0	535.6	100.0
Northeast	40.2	2.7	414	4.6	410.4	25.3	1,368.8	25.4	14.8	2.8
North	1,051.2	70.1	1,368	15.2	615.0	38.0	923.0	17.1	10.5	1.9
Northwest	280.7	18.7	4,936	55.4	460.7	28.4	2,424.2	44.9	49.2	9.2
Southwest	49.2	3.3	585	6.5	134.0	8.3	408.0	7.6	392.5	73.3
Central-South	56.3	3.7	747	8.3	----	----	274.0	5.0	57.3	10.7
East	22.4	1.5	900	10.0	----	----	----	----	11.3	2.1

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[1] Bazhenov, Leonenko, and Kharchenko, op. cit., p. 44.

[2] Calculated from basin totals in Meyerhoff and Willums, op. cit., p. 201.

[3] Wu, op. cit., p. 167.

Northeast and North with nearly 30 percent of China's population and more than 45 percent of gross industrial output are fortuitously provided with abundant reserves of both coal (nearly 75 percent of the total) and crude oil (about 63 percent). However, as already pointed out, these reserves are supplying the bulk of the country's production and they are being extracted faster than any other fuel deposits throughout China. Consequently, unless they will be substantially enlarged by further exploration, the more remote regions will have to balance their decline, which could come in the case of crude oil as early as the late 1980's—but more likely sometime in the 1990's. Northern coal reserves are so huge that the regional shift will not come because of physical exhaustion but rather because of the increasing cost as well as the need to distribute the production more equally.

In contrast to the richly endowed North and Northeast, the East, with one-fifth of the total population and nearly 30 percent of industrial output, is almost devoid of any significant fuel, as well as hydro, resources. Barring unlikely early discoveries of huge and cheap offshore oil and gas deposits the East will remain a large importer of energy. A large territory of Central South and Southwest, housing over two-fifths of China's people and producing 20 percent of its industrial goods is only slightly better off than the East—with the notable exception of a large hydropower concentration in extremely inaccessible eastern Tibet and western Szechwan.

It is to the Northwest—remote, severely inhospitable, thinly populated (less than 7 percent of the total), unindustrialized (less than 5 percent of gross industrial output) and still only tenuously linked to the rest of the country—where the Chinese will have to turn for their future fuel needs, a westward shift of energy centers comparable in its magnitude to the eastward shift of the Soviet energetics [96]: Northwest has no less than half of China's ultimate coal resources and nearly half of her estimated recoverable onshore oil supplies. The only major way to postpone this costly and complicated shift would be to turn offshore first and to plunge into certainly no less expensive and difficult search and production of undersea hydrocarbons. This is not, as yet, a pressing dilemma—but it will have to be resolved sometime during the next decade; otherwise it would be extremely difficult to keep China's energy consumption on its fast, and much needed, exponential rise.

ENERGY CONSUMPTION AND FUTURE DEMAND

Judged in absolute terms, the record has been quite impressive: China's primary energy consumption, which was barely over 20 mmtce in 1949, grew nearly tenfold in a decade, topped, after years of politically-induced stagnation, 300 mmtce in 1972 and is now exceeding 500 mmtce. In aggregate terms, China has thus become the world's third largest energy consumer, just ahead of Japan [97]—and very far behind the Soviet Union and the United States (figure 5). Per capita consumption, naturally, remains rather low: At around 500 kgce annually it is more than double of India's modern energy usage, but less than half of Mexico's figure—and an order of magnitude less than the consumption of developed nations; addition of the still important traditional fuels increases the aggregate value to some 600

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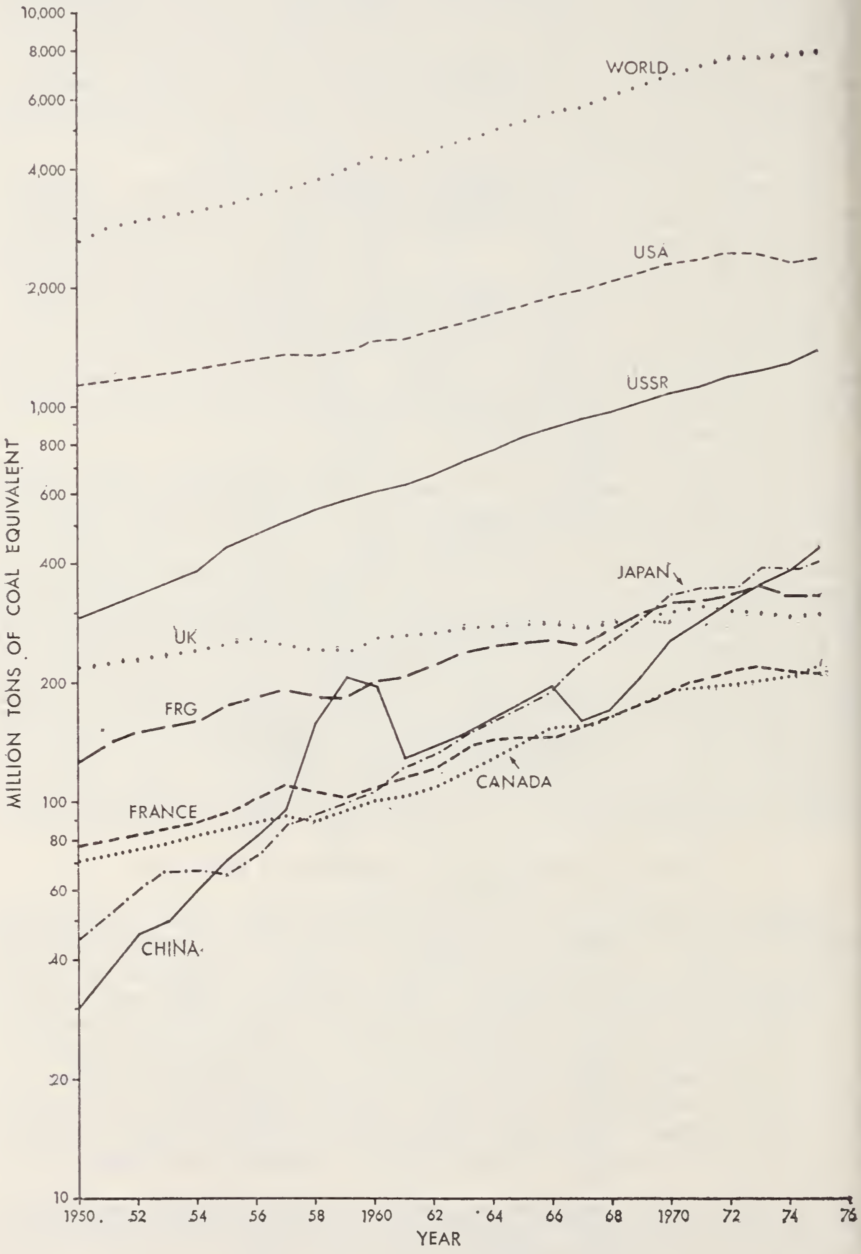
[96] In 1960 Siberian crude oil accounted for mere 1.1 percent of the national production, natural gas for 0.7 and coal for 28 percent; in 1980 these shares will be about 50, 35, and 38 percent and the strong eastward shift will continue afterwards (A. B. Smith, "Soviet Dependence on Siberian Resource Development" in "Soviet Economy In a New Prespective" (Washington, D.C., USGPO, 1976), p. 482).

[97] This ranking and the distances among individual countries are greatly influenced by multipliers used to convert different fuels to a common denominator (for details on conversions see appendix D).

FIGURE 5.—World's leading energy-consuming nations. Primary energy consumption according to the UNO, World Energy Supplies (New York, UNO, annually), except for China. Chinese totals are from V. Smil, China's Energy, op. cit., p. 141.



mmtce in 1976 and the annual per capita usage to nearly 650 kgce.[98]

Even after leaving out the economic recovery period of the years 1949–52, the long-term (1952–76) exponential growth rate of energy use equalled 9.3 percent annually, a pace superior to the consumption increases of all other large (more than 50 million) developing nations.[99] Naturally, this fast consumption rise fueled the strong, though erratic, expansion of industrial output and construction—as well as the costly nuclear capability.

However, almost until the beginning of this decade, agricultural production was receiving only minuscule amounts of the growing consumption and even today the energy flows into farming are still much less than desirable. And although the industry has been consuming by far the largest share of the national total it, too, is short of fuels and electricity.

Future energy requirements of the Chinese economy are thus truly immense, especially should the country move vigorously toward the goal outlined by its late Premier: To accomplish the comprehensive modernization of agriculture, industry, natural defense and science and technology so that China's economy will be advancing in the front ranks of the world by the end of this century.[1] Restructuring of sectoral uses, improved efficiency of industrial consumption and increased energy subsidies into agriculture will have to be the major tasks on the difficult road toward that ambitious goal.

Sectoral Uses

Direct information about final energy uses in China has been extremely scarce, a problem which might not be difficult to overcome by calculations should the appropriate sectoral output and conversion data be available. Unfortunately, such figures are very fragmentary and, consequently, our sectoral consumption data must be built on cumulative assumptions and estimates. While the absolute values, especially for the 1960's and 1970's may be arguable, the relative importance of individual sectors and the general consumption trends can be portrayed satisfactorily (table 7).[2]

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[98] Per capita primary energy consumption (all values are in kgce/year/capita) is over 11,000 in the United States, nearly 4,000 in Japan and averages around 5,000 in both the EEC and Comecon countries. Inclusion of traditional fuels (firewood, crop residues, dung) in Indian energy consumption raises the per capita value quite dramatically: from about 200 to some 490 kgce/year/capita (R. Revelle, "Energy Use in Rural India", Science, Vol. 192, No. 4243 (4 June 1976), p. 969).

[99] India, Pakistan and Indonesia have experienced energy consumption growth rates between 5 and 6 percent and Brazil, Nigeria, and Mexico around 7 percent (V. Smil, China's Energy, op. cit., p. 153).

[1] Chou En-lai, "Report on the Work of the Government", Peking Review, Vol. 18, No. 4 (24 January 197.5) p. 23.

[2] For only slightly different estimates see the CIA series in "China: Economic Indicators," op. cit., p. 27:

TABLE 7.—SECTORAL CONSUMPTION OF PRIMARY ENERGY IN CHINA, 1950–76[1]

[All values are in million metric tons of coal equivalent and, in parentheses, in percent]

	Total	Electricity generation	Industry	Transportation	Agriculture	Residential and commercial
1950	30.4 (100)	3.6 (12)	3.9 (13)	3.3 (11)	Negligible	19.6 (64)
1952	47.5 (100)	4.4 (9)	12.6 (27)	5.0 (11)	0.1(<1)	25.4 (53)
1957	96.5 (100)	8.8 (9)	28.9 (30)	9.3 (10)	.6 (1)	48.9 (51)
1960	198.3 (100)	20.0 (10)	105.3 (53)	15.5 (8)	5.5 (3)	52.0 (26)
1965	178.4 (100)	15.7 (9)	75.2 (43)	14.3 (8)	6.1 (3)	66.1 (37)
1970	251.4 (100)	21.6 (9)	115.4 (46)	19.9 (8)	13.0 (5)	81.5 (32)
1974	377.0 (100)	33.6 (9)	193.5 (51)	26.4 (7)	18.2 (5)	105.3 (28)
1976	445.0 (100)	42.0 (9)	228.4 (51)	31.5 (7)	27.6 (6)	115.5 (26)

[1] 1950–74: V. Smil, "China's Energy", op. cit., p. 150; 1976: my calculations using the same derivation procedures as for 1974 and appropriate inventory and performance figures for 1976 estimated in CIA, "China: Economic Indicators," op. cit., passim.

The most striking feature of the Chinese sectoral energy use is the large share of the industrial consumption; even with power generation requirements classified separately, industry now draws about half of all China's primary energy, a sharp increase in comparison with the early 1950's.[3] On the other hand, relative importance of residential and commercial uses has declined considerably since the late 1950's and, significantly, both the power generation and transportation shares, in spite of large absolute increases, have also diminished. Agriculture consumed about 46 times more commercial energy in 1976 than it did at the end of the First Five-Year Plan two decades ago—but in relative terms it is still no more than about 6 percent.

A more detailed look at the recent consumption pattern—by sector and source (table 8 and figure 6)—reveals important weaknesses in the Chinese energy use. About one-third of raw coal is consumed for residential heating, one of the least efficient—and relatively most polluting—fuel conversions, while the household use of refined oil products remains negligibly low.[4] Some four-fifths of energy consumed in transportation are solid fuels which are very inefficiently converted into motion by steam locomotives, still the principal power sources of the Chinese railways.[5] Most importantly, a great deal of energy is wasted in virtually all industrial processes.

TABLE 8.—CHINA'S CONSUMPTION OF PRIMARY ENERGY BY SECTOR AND SOURCE IN 1974[1]

	Total	Industry	Agriculture	Transportation	Household and commerce
Coal	251.2 (100)	140.9 (56)	2.5 (1)	22.3 (9)	85.5 (34)
Crude oil	75.9 (100)	55.7 (73)	15.1 (20)	4.1 (6)	1.0 (1)
Natural gas	46.6 (100)	28.0 (60)			18.6 (40)
Hydroelectricity	3.3 (100)	2.5 (76)	.6 (18)		.2 (6)
Total	377.0 (100)	227.1 (60)	18.2 (5)	26.4 (7)	105.3 (28)

[1] For derivation of the estimates see V. Smil, "China's Energy," op cit., pp. 146–149.

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[3] However, these industrial consumption estimates are certainly somewhat exaggerated because they were determined as residuals after accounting for all other sectoral uses and include also transportation and storage losses, fuel stocks, non-fuel uses (these are separated in figure 6) and military needs. For comparison, the 1974 industrial energy consumption in the United States was 23.3 percent of the total use, in Japan 36.8 percent and in major Western European nations between 25–30 percent (OECD, "Energy Balances of OECD Countries" (Paris, OECD, 1976) passsim).

[4] In physical units it translates to about a quart of fuel oil (little less than 1 litre) per year per capita.

[5] According to the CIA estimates, 75 percent of mainline locomotives in 1975 were steam-powered, only one percent electric and the rest were diesel engines (CIA, "China: Economic Indicators," op. cit., p. 35). In steam locomotives, coal is converted into mechanical energy with less than ten percent efficiency, while the rate in diesel engines is well over 30 percent (C. M. Summers, "The Conversion of Energy", Scientific American, vol. 224, No. 3 (September 1971), p. 151).

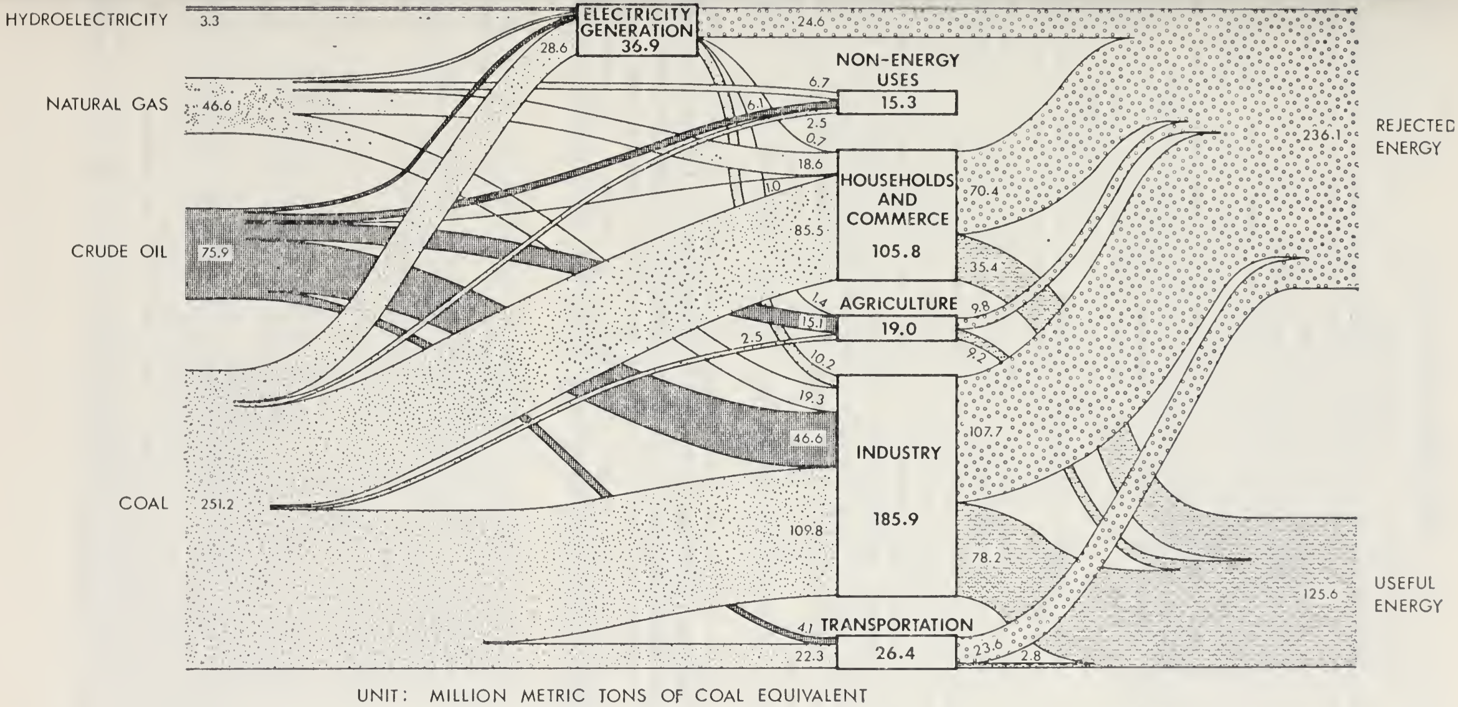
HYDROELECTRICITY
3.3
NATURAL GAS
46.6
CRUDE OIL
75.9
COAL
251.2
28.6
ELECTRICITY GENERATION
36.9
24.6
NON-ENERGY USES
15.3
6.7
6.1
2.5
0.7
18.6
1.0
HOUSEHOLDS AND COMMERCE
105.8
85.5
70.4
35.4
1.4
AGRICULTURE
19.0
15.1
2.5
10.2
9.8
9.2
19.3
46.6
INDUSTRY
185.9
109.8
107.7
78.2
4.1
TRANSPORTATION
26.4
22.3
23.6
2.8
236.1
REJECTED ENERGY
125.6
USEFUL ENERGY
UNIT: MILLION METRIC TONS OF COAL EQUIVALENT

FIGURE 6.—Commercial energy flow pattern for China in 1974. Derivation of the pattern is outlined in app. E. For comparison, identically structured energy flow patterns for the United States in the years 1960, 1970, 1980, and 1985 can be found in Joint Committee on Atomic Energy, "Certain Background Information for Consideration When Evaluating the National Energy Dilemma" (Washington, D.C., USGPO, (1973)), foldouts A–D.

Industrial Consumption

Recent research efforts to disaggregate the energy demand into detailed components and to subject individual industrial processes to a systematic energy analysis have abundantly illustrated numerous savings to be made through production adjustments, conservation measures and material or energy substitutions even in the most advanced economies.[6] Although the Chinese have been engaged in almost incessant campaigns to save fuels and electricity—and have also taken some desirable steps toward residual heat utilization—the potential energy savings in the country's industries are immense.

In absolute terms, the Chinese iron and steel industry is certainly the branch with the greatest energy waste. Conversion of poor quality coking coal results in high benefication losses even in the case of large enterprises;[7] coke charging in modern plants was still about 700 kg per ton of pig iron in the late 1960's and was estimated at 650 kg in 1974; moreover, in small local plants, which now produce 27 percent of China's iron and 11 percent of her steel,[8] coke requirements are as high as 900–1,000 kg per ton of pig iron.[9] Poor ore, relatively small blast furnaces, still infrequent partial substitution of coke by an injection of fuel oil or natural gas, scarcity of scrap and the heavy dependence on energy-intensive open-hearth furnaces in steelmaking are other principal factors explaining China's inordinately high energy consumption in this essential industrial activity:[10] Iron and steelmaking require nearly one-fourth of the national raw coal consumption and this, in turn, accounts for almost 30 percent of the total industrial energy usage.[11]

International comparisons of energy consumption in steel industry reveal still better China's unenviable situation. In China, raw coal requirements alone translate into approximately 17,000 kcal per kg of crude steel in 1974,[12] while, in the same year, total direct energy inputs (solid fuels, fuel oils, gases and electricity) to produce 1 kg of crude steel in major Western producers and in Japan ranged between 4,400–5,500 kcal.[13]

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[6] For excellent reviews see, among others, R.H. Socolow, op. cit.; Workshop on Alternative Energy Energy Strategies, op. cit., and 9th International TNO Conference, "The Energy Accounting of Materials, Products, Processes and Services" (Rotterdam, TNO, 1976).

[7] Usack and Egan estimate that about three tons of raw coal are needed to produce a ton of coke concentrate in large enterprises and that the ratio is as high as 4.5.1 for small plants: A. H. Usack, Jr. and J. D. Egan, "China's Iron and Steel Industry," in China: A Reassessment of the Economy," op. cit., p. 272. For comparison, in the United States coke ovens 1.43 tons of coal are needed to produce a ton of coke: Federal Energy Administration, "Project Independence," Vol. 3 (Washington, D.C., USGPO, 1974), p. 6–15.

[8] Pien Hui, op. cit.. p. 21.

[9] Because metallurgical coke is still the most expensive fuel used by iron and steel industry, its partial replacement by injections of fuel oil or natural gas has recently led to input values of well below 500 kg of coke per ton of pig iron in many Western European nations and in Japan: A. Decker, "Energy Accounting of Steel" in 9th International TNO Conference, op. cit., pp. 95–107: Eurostat, Quarterly Iron and Steel Statistical Bulletin (Luxembourg, Statistical Office of the European Communities, quarterly).

[10] More than two-thirds of the Chinese pig iron capacity are in furnaces with volumes less than 1.000 m^3 and the largest furnace has 2.005 m^3; open-hearth furnaces still account for 60–70 percent of steel making capacity (A. H. Usack, Jr., and J. D. Egan op. cit., p. 280).

[11] These shares are based on Usack's and Egan's calculations of about 87 mmt of raw coal needed in iron and steel making in 1974 (A. H. Usack, Jr. and J. D. Egan, op. cit., p. 271), conversion coefficient of 0.7 for large coal production and 0.5 for small coal output, and the industrial consumption (excluding power generation) of 194 mmtce in 1974.

[12] Calculated by multiplying modern plant raw coal consumption of 51 mmt by 0.7 to get 35.7 mmtce, and small plant consumption of 36 mmt by 0.5 to obtain 18 mmtce, and dividing the energy equivalent of 3.76×10^{14} kcal by the 1974 crude steel output of 23.8 mmt.

[13] Obtained by dividing the annual crude steel production figures of the United States, Japan and Western European nations (UNO, 1976 Statistical Yearbook (New York, UNO, 1977), p. 320) into the appropriate total energy uses in iron and steel industry (OECD, op. cit.).

Another important sector where small plants are turning out an exceedingly energy-intensive product is the fertilizer industry, above all the enterprises synthesizing aqueous ammonia and ammonium bicarbonate.[14] Available evidence shows that the production of one kg of nitrogen in these small units—which provided one-half of the domestic output in 1974—requires energy inputs (coal, coke, coke oven gas, electricity) between 23,000–31,000 kcal;[15] in comparison, large, modern ammonia and urea plants, which the Chinese purchased from the United States, Netherlands, Japan and France, synthesize one kg of nitrogen with no more than 11,300–17,700 kcal of total feedstock and process energy.[16] Similar, though very likely not so glaring, efficiency differences could be certainly found in other industrial processes, above all in color metallurgy, cement production and crude oil refining.[17]

Lowering of specific fuel consumption in thermal power generation has been a constant preoccupation in the Chinese electricity production but the last reliable published average national heat rate—604 g of standard coal per kWh in 1957 [18]—was some 20 percent above the comparable Soviet value and nearly 50 percent greater than the average U.S. consumption.[19] Although this huge gap has been certainly narrowed during the past two decades, great differences must prevail even in the case of large modern powerplants because the typical sizes of the Chinese turbogenerators—25–125 MW [20]—are still too small to approach the thermal efficiencies of large Western or Soviet units.[21]

In view of these numerous conversion inefficiencies the share of useful energy—estimated to equal one-third of the total consumption in 1974 (figure 6)—may be actually even lower.[22] In any case, the Chinese energetics faces a difficult, though rewarding, task to improve its conversion rates by elimination or modification of appealingly simple but energetically wasteful production processes, widespread conservation, introduction of new technologies and larger units to benefit from considerable economies of scale and by the increased use of the total energy systems. A no less important task for China's industries will be to provide greatly increased energy subsidies for the country's agriculture.

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[14] Small plants producing mainly these two fertilizers accounted for one-half of 3.2 mmt of nitrogen output in 1974 (CIA, "People's Republic of China: Chemical Fertilizer Supplies, 1949–74" (Washington, D.C., CIA, 1975), p. 14).

[15] These are my calculations (using rather conservative assumptions as far as the energy content of fuels is concerned; if the actual raw material and process fuel inputs are of better quality, the energy cost of fertilizers would be even higher!) based on about half a dozen input budgets given in J. Sigurdson, 'Rural Industrialization in China" in "China: A Reassessment of the Economy," op. cit., pp. 420–421.

[16] The average value for the United States 1973 ammonia output was 11,318 kcal/kg of N (E. T. Hayes, "Energy Implications of Materials Processing", Science, Vol. 191, No. 4228 (20 February 1976), p. 664); European values for ammonia and urea at the beginning of this decade were between 13,400–17,700 kcal/kg of N (G. Leach and M. Slesser, "Energy Requirements of Network Inputs to Food Producing Processes" (Glasgow, University of Strathclyde, 1973), pp. 21-25).

[17] Chinese do not have large quantities of old metals which can be recycled at fractional energy cost compared with primary production; 60 percent of cement output is coming from small and medium enterprises at certainly greater energy cost than from the modern rotary kilns; some refining equipment is quite old and hence rather inefficient.

[18] Wu, op. cit., p. 107.

[19] Soviet heat rate in 1957 was 3,507 kcal/kWh (TsSU, op. cit., p. 238) and the average value for the United States fossil fueled generation was 2,864 kcal/kWh (Federal Power Commission, "National Power Survey," Part I (Washington, D.C., USGPO, 1964), p. 67).

[20] So far, only several 200 MW units and two 300 MW turbogenerators have been built on a trial basis.

[21] The largest Western units are now well in excess of 1,000 MW with typical new turbogenerator ratings above 500 MW.

[22] For comparison, the useful energy in the United States amounted to 49.3 percent in 1960, 50.5 percent in 1970 and it would—without a significant conservation effort—decrease to about 45 percent in 1980 and to only 40 percent in 1985 (Joint Committee on Atomic Energy, op. cit., pp. 4–6).

Agricultural Modernization

Undoubtedly the most important near-term goal for the Chinese economy is to modernize the country's agriculture and village life by sharply reducing the reliance on renewable animate power and phytomass and to make the countryside much more dependent on fossil fuels and electricity. This is, of course, the aim of the "basic farm mechanization," a rather loosely defined program which means that more than 70 percent of all principal field, forestry, animal husbandry, fishery and side-line activities should be taken over by machines. The year 1975 was Mao's original deadline for this complex and costly accomplishment;[23] now 1980 is Hua's new target and it is quite clear that it, too, will not be met. Slogans and deadlines aside, this is, naturally, a crucial task and it is revealing to evaluate the quantities of modern energy needed to accomplish—and to sustain—this unprecedented rural transformation.

To begin with, how much energy will be required to eliminate some three-quarters of all animate labor in the Chinese countryside? In mechanized farming, virtually all fieldwork (tilling, sowing, transplanting, cultivating, applying fertilizers and pesticides, and harvesting) and transportation of products and provisions would be performed by tractor-drawn implements (and also some trucks), while irrigation, drainage, crop processing (grain milling, oil pressing, sugar extraction) and fodder preparation require machinery powered either by internal combustion engines or by electric motors.

Although the Chinese are building 75-horsepower tractors (and importing even bigger ones) and increasingly installing high-power water-pumping equipment, most of this machinery has been—and will continue to be—rather small. Nearly 20 percent of the tractor park in 1976 were garden tractors, with drawbar horsepower of four, and among the wheel tractors the one produced in the greatest volume has been a 54-horsepower (36 horsepower at the drawbar) machine;[24] similarly, most of the more than 1 million tubewells on the North China Plain have a capacity of only 1.5–2 m^3 per second.[25] Average power of farm machinery in Wu-sih County, a showplace of rural mechanization in Kiangsu, typifies the situation in rice-growing areas: mean power of tractors is slightly over 12 horsepower and that of electrical and diesel motors only about 7 horsepower.[26]

Gross efficiency of this small-scale machinery is rather low. Depending on a host of circumstances (rolling resistance, soil and crop conditions, work speed, engine and its state etc.) the useful work performed by small and medium tractors (drawbar horsepower 4–40) is equal to anywhere between 5–20 percent of the total fuel consumption; assuming the average 15 percent efficiency is not certainly too conservative.[27] Power unit energy efficiencies for common motor use in water pumping range, with well-maintained equipment, between 20 percent for natural gas engines and 27 percent for diesel engines;[28] 25 percent may be taken as a somewhat liberal average. Water pumping efficiencies vary greatly with pump type and age and with the rate of pumping: assuming the average efficiency better than 60 percent is quite unrealistic.[29] Multiplying the two average values (0.25×0.6) results in the overall efficiency of 15 percent.

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[23] Mao Tse-tung, "Summing-up Speech at the Sixth Expanded Plenum of the Seventh Central Committee (September 1955)" in "Miscellany of Mao Tse-tung Thought," English translation in JPRS, No. 61269 (Feb. 20, 1974), p. 16.

[24] CIA, "Production of Machinery and Equipment in the People's Republic of China" (Washington, D.C., CIA, 1975), pp. 13–14.

[25] D. D. Perkins, "A Conference on Agriculture," "The China Quarterly," No. 67 (September 1976), p. 606.

[26] Chin Chi-chu, "Revolutionization in Command of Mechanization," Peking Review, Vol. 20, No. 33 (Aug. 12, 1977), p. 38.

Consequently, replacing three-quarters of the current 60 trillion kcal of the useful human and animal rural labor with machinery whose gross efficiency is not higher than 15 percent would call for an annual direct expenditure of at least 300×10^{12} kcal ($60 \times 0.75/0.15$) or about 43 mmtce; inadequate maintenance and inexperienced operation and management might raise this total easily to about 50 mmtce per year.[30] To this must be, of course, added the not inconsiderable energy requirements for producing chemical fertilizers, field, water pumping and processing machinery and many other minor farm inputs.

When the large number of recently built ammonia and urea plants will have become fully operative, they will produce 3.5 mmt of nitrogen annually and the national total should reach 8 mmt of nitrogen in 1980.[31] Taking the average value of 17,600 kcal of feedstock and process energy per kg of nitrogen[32] the aggregate fuel and electricity inputs to supply the country with nitrogen fertilizers would be about 140×10^{12} kcal—or 20 mmtce—per year at the beginning of the next decade. Approximately another 14×10^{12} kcal (2 mmtce) would be needed to produce adequate amounts of phosphorus and potassium.[33]

To displace three-quarters of animate labor, inventories of fossil-fueled or electricity-powered machinery would have to at least double in comparison with the mid-1970's.[34] Assuming approximately 50 kg of steel per horsepower and no less than 20,000–25,000 kcal per kg of machinery, annual production of some 20 million horsepower would require 3–3.5 mmtce energy[35] and adding the energy cost of scores of field implements and crop processing machinery, trucks, spare parts, storage sheds and repair shops, as well as the feedstock and process energy requirements for insecticides and herbicides, would easily double this figure.

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[27] For details on power requirements and performance calculations for tractors and other agricultural machinery see American Society of Agriculture Engineers (ASAE), "Agricultural Engineers Yearbook" (St. Joseph, Mich., ASAE, annually). For details on the Chinese tractors see JPRS, No. 63091 (Sept. 30 1974).

[28] C. H. Pair, "Sprinkler Irrigation" (Washington, D.C., Sprinkler Irrigation Association, 1969). Only large electric pumps using hydroelectric power from major stations would have a higher overall efficiency; smaller pumps powered by hydroelectricity from local small projects and all electric pumps running on power from fossil fueled stations would have equally low gross efficiencies. For interesting comparisons of powered pumping with animal and human-operated devices see A. Molenaar, "Water Lifting Devices for Irrigation" (Rome, FAO, 1956).

[29] J. Keller, Department of Irrigation Engineering, Utah State University, Logan, Utah.

[30] Complaints about the low standard of management and extreme shortages of trained personnel to properly operate and repair the machinery have been appearing increasingly in the Chinese broadcasts. See, for example, Kwangtung provincial broadcast, SWB, FE/W950/A/4 (October 12, 1977) and Kwangsi-Chuang regional broadcast, ibid.

[31] CIA, "People's Republic of China: Chemical Fertilizer Supplies, 1949–74", op. cit., p. 9.

[32] This is the average world value calculated from energy costs of major kinds of nitrogen fertilizers (G. Leach and M. Slesser, op. cit., p. 30).

[33] This assumes attainment of the optimum ratio of approximately 100 units of nitrogen to 50 units of phosphorus and 33 units of potassium, and the average energy costs according to G. Leach and M. Slesser, op. cit., p. 34.

[34] Tractor production in 1974–76 was between 2.25–2.86 million housepower annually and the output of powered irrigation equipment reached 7 million horsepower in 1975 (CIA, "China: Economic Indicators" op. cit., p. 18).

[35] These are rather conservative assumptions based on the weights and energy costs of a wide variety of the U.S. water pumping and field machinery.

Indirect energy subsidies in agricultural chemicals and machinery would be thus about 30 mmtce annually and direct liquid fuel and electricity inputs for tractors and water pumping would bring the total energy cost of basic farm mechanization to no less than 80 mmtce per year. Furthermore, cutting the rural dependence on forest fuels, grasses and crop residues also by about three-quarters from its mid-1970's level would require—even when assuming doubled combustion efficiency—another 50–60 mmtce of solid and liquid fuels.

This approximate analysis makes clear the enormous energy cost of what would be merely basic rural modernization in the world's most populous nation. Further energy subsidies would be, of course, needed to raise the crop yields, extend the irrigated land, increase multicropping, mechanize construction and repairs of water projects, build modern roads and improve living conditions of peasants. Regardless how fast and with what real success the Chinese will move toward the still distant goal of nationwide rural modernization, direct and indirect energy flows into agriculture will have to take up a much larger share of the country's future energy consumption.

FUTURE ENERGY NEEDS

If China wants to achieve her ambitious developmental goals, her economy will have to maintain expansion rates at least equal to the best periods of its past performance. The annual exponential GNP growth rate for both the first Five-Year Plan (1953–57) and for the post-Cultural Revolution years of renewed economic expansion (1969–76) was 7.2 percent; the long-term rate for 1949–76 equalled 6.85 percent.[36] It would thus seem that the Chinese economy would do very well maintaining 7-percent growth rate for another decade—and thus doubling its size—and it would not do badly to advance at 6-percent rate.

As in any other nation, economic growth and energy consumption in China are closely related: GNP-energy linear regression for the years 1949–76 has a correlation coefficient 0.973 and explains 94.77 percent of the variance.[37] This strong relationship offers a better short-term forecasting tool than the often used GNP-energy elasticity coefficients.[38] Taking 6 and 7 percent as the desirable lower and upper limits, China's GNP (in 1976 U.S. dollars) would grow to approximately $410–$425 billion in 1980 and to $550–$600 billion in 1985 and primary energy required to support this growth would range roughly from 530 to 560 mmtce in 1980 and between 730–800 mmtce in 1985.

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[36] Calculations based on the CIA's GNP estimates in CIA, "China: Economic Indicators", op. cit., p. 3.

[37] Calculated on the basis of the CIA's GNP data (CIA, "China: Economic Indicators" op. cit., p. 3) and my energy consumption estimates (V. Smil. ((China's Energy," op. cit., p. 141 for 1949–74; the values used for 1975 and 1976 were 415 mmtce and 447 mmtce). The linear equation has the form $Y=-6.0633\times10^{7}+1.4499\times10^{-3}X$, where Y is the energy consumption in mmtce and X is the GNP in billions of 1976 U.S. dollars.

[38] Major problem with elasticity coefficients is that regardless which method of calculation is used, one obtains different results for different periods. For example, using the data described in footnote 37 and the classical formula for period elasticity—$e=((\Delta E/E)/(\Delta G/G)$—China's energy/GNP elasticities are 3.2 for 1953–76 1.9 for 1969–76 and 2.6 for 1973–76. Similarly, division of the compound GNP growth rate into the compound growth rate of energy consumption (the annual method) results in elasticity coefficients 1.8 for 1953–76, 1.6 for 1969–76 and 2.4 for 1973–76. These temporal variations do not make energy/GNP elasticities a reliable forecasting tool. On the other hand, energy-GNP linear regressions for individual countries are uniformly and extremely high, providing a reasonable basis for short-term forecasts (V. Smil and T. Kuz, "Energy and the Economy—A Global and National Analysis", Long Range Planning, vol. 9, No. 3 (June 1976), pp. 65–74).

Continuation of the historical production growth rate of about 9 percent until the mid-1980's would bring the primary energy output to approximately 650 mmtce in 1980 and to 1,000 mmtce in 1985 and leave a considerable surplus for export (about 100 mmtce in 1980 and perhaps over 200 mmtce in 1985). However, while not impossible, such a growth rate is not very likely: it is the basic property of any growth process that large, complex systems cannot simply continue to expand at fast pace.

The only two countries which had topped 500 mmtce energy production level and went on to expand it beyond 1,000 mmtce—the United States and the Soviet Union—have both experienced much lower growth rates. The Soviet analogy is certainly more appropriate: The country's primary energy output topped 500 mmtce as recently as 1956 and surpassed the 1 billion mark in 1966, growing at about 6.7 percent annually; [39] the expansion had not been limited by availability of energy resources but solely by investment and technological considerations. It must be also remembered that the Soviets profited from major transfers of advanced foreign technology.

Expansion of the Chinese primary energy production by 7 percent per year for another decade would have to be then termed a success; it would bring the output to just over 600 mmtce in 1980 and to some 850 mmtce in 1985, meeting the likely domestic requirements and leaving a small, though valuable, export surplus equal, in crude oil terms, to some 40 mmt in 1980 and 60 mmt in 1985.

The actual course of affairs will be, of course, determined by the Chinese choice of developmental strategies.

DEVELOPMENTAL STRATEGIES

Erratic course of the Chinese economic development during the 27 years of Mao's fluctuating leadership had left hardly a trace of a "normal" policy record which might be used to extrapolate at least into the near future. And although virtually all events since the fall of 1976 point to a deepening shift away from Maoist-inspired radicalism to sensible pragmatism, the generational succession has yet to run its full course and the stability of the post-Mao leadership has yet to be tested.

Nevertheless, as "the true powers of individuals, groups, and political bodies lie in the useful potential energies that flow under their control,"[40] vigorous expansion, qualitative improvement and a more equal distribution of energy flows must be the goals of any but a suicidal leadership. Their pursuit in the Chinese setting will inexorably require the continuation and intensification of many recent trends.

Modernization of coal mining and transportation, intensive hydrocarbon recovery from the largest producing oil and gas fields and extensive exploratory drilling (including shallower offshore waters), construction of interprovincial pipelines, further substitution of coal by liquid and gaseous fuels, greatly increased energy subsidies into agricultural production and significant improvement of conversion efficiencies must be at the top of any list of priorities if China is to make significant progress in economic modernization and improvements in the standard of living. The scale of this effort is staggering and just a few quantitative indicators and comparisons illustrate the immensity—and impossibility—of an attempt to surpass world's advanced levels before the end of this century.[41]

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[39] TsSu, op. cit., p. 239.
[40] H. T. Odum, "Environment, Power and Society," op. cit., p. 206.

To maintain a fast pace of primary energy production, the Chinese coal industry is to double its output in the next 10 years:[42] This means an average exponential growth rate of 7 percent per year and the total output in excess of 1 billion tons of raw coal in 1988. However, as both the Soviet Union and the United States have been finding out, the cost, the environmental problems and the logistics of producing more than a half billion tons of coal annually is sharply curtailing any fast growth rates; since topping that mark, the U.S. coal output has been growing by only 2.1 percent per year and the Soviet production by mere 1.4 percent.[43]

Crude oil production will have to be expanded considerably—but exponential growth of no more than 10 percent per year would exhaust the Chinese onshore reserves of around 5 bmt by the mid-1990's. Chinese are, of course, well aware of this fact, as exemplified by Hua's call to discover 10 more Ta-ch'ings; even should the required reserves be in the ground, the Chinese investment to discover and to develop them might be of the same order of magnitude as the Soviet oil industry's expenditures during the past 20 years.[44]

Every step of large scale fossil fuel development—exploration, production, transportation and conversion—requires complex and expensive technology (virtually all of it based on high quality steel) and well-trained labor force backed up by long-range planning and management and by intensive research. So far, Chinese have not excelled in any of these activities. In spite of impressive progress in many areas, China's domestic energy technologies lag considerably behind the world standards and resemble the United States or European status of, depending on particulars, two to four decades ago;[45] Communist Party's ever-changing "line" has been hardly conducive to serious long-range planning and the disdain of intellectuals and scientists—a practice only recently discarded—has damaged the country's research and development effort immeasurably.

Consequently, China's modernization pace will depend to a considerable degree on the willingness and ability to promote rational planning, research, and management, and to import advanced foreign technologies. The option of complete self-reliance has been always a useless myth: Even the most advanced industrialized nations are not self-sufficient in certain major branches of increasingly complex energy technologies.

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[41] The only way how this Mao's old (1956) call—"This is an obligation . . . if after much ado for 50 or 60 years you are still unable to overtake the United States, what a sorry figure you will cut! You should be read off the face of the earth."—could be treated seriously is assuming that it requires China to produce greater absolute quantities of certain industrial products (steel, cement) and fossil fuels. In relative (per capita) terms, China's best conceivable performance cannot even remotely approach the U.S. levels—unless, of course, there will be a collapse of the Western civilization.

[42] This goal was revealed by Hsiao Han, Minister of Coal Industry, in his article "Developing Coal Industry at High Speed", Peking Review, vol. 21, No. 8 (Feb. 24, 1978), p. 6; another doubling is to be achieved between 1987 and 2000!

[43] Growth rates calculated from production data in USBC. op. cit., p. 710 and TsSu, op. cit., p. 247.

[44] Conservative estimates of Ta-ch'ing's ultimate production are at least 400–500 mmt (Meyerhoff and Willums, op. cit., p. 179). Discovery of 10 more Ta-ch'ings would thus entail crude oil reserves of no less than 4–5 bmt, the mass about equal to the best current estimates of China's total recoverable onshore deposits (see table 5). Comparison with the Soviet effort is based on the fact that the Soviet crude oil production rose from 98.3 mmt in 1957 (about equal to China's 1978 output) to 519.7 mmt in 1976, the total which would be reached by the Chinese with 10 percent exponential growth by 1995. It should be pointed out that the Soviets achieved this growth with a considerable transfer of Western, as well as Comecon, technology, with tapping of extraordinary supergiant Samotlor field—and without virtually any expensive offshore drilling.

[45] For a brief quantitative international comparison of China's energy technologies see V. Smil, "China's Energy," op. cit., pp. 179–185. Relatively low or only moderately advanced state of domestic technology does not, however, stop the Chinese in issuing false statements about superior level of their devices. One of the recent glaring examples was the claim that a new Szechwanese natural diamond drilling bit was capable to penetrate 327.22 meters in 500 hours and 23 minutes, thus more than doubling the record for foreign diamond bits said to be only 155.7 meters: Szechwan provincial broadcast, SWB, FE/944/A/6 (Aug. 31, 1977). In fact, in mid-1950's the Gulf Oil Corp. drilled a 10,000-ft (3,048 meters) hole in Louisiana with one diamond bit in 3 days, and the Chinese "record" has been surpassed in numerous locations around the world (A. A. Meyerhoff, personal communication).

This raises, of course, the problem of hard-currency payments and the question of how far China's barter of energy for technology might go. Because the country's potential needs for foreign technology are so immense, it seems safe to conclude that unless the country would open herself to long-term joint ventures or choose to accept large loans or amass sizeable trade deficits—developments considered rather improbable by most outside observers—it is most unlikely that they could be satisfied by regular trade alone.[46]

Not unexpectedly, the old-new leadership, recognizing the need for wide-ranging technology imports, chose a compromise by concluding a $9 to $11 billion medium-term deferred-payment trade treaty with Japan in February 1978.

Under the treaty's terms Japan will build six large industrial plants, including a giant integrated steel complex to boost China's lagging production by 6 mmt annually. Partial payment will come from exporting the total of 47 mmt of crude oil and about 9 mmt of coal over the next 5 years.[47] This deal is a clear indication of both China's technology needs and her energy export limitations. Annual shipments of about 15 mmtce to Japan between 1978–1982 are minuscule in international comparison and their further growth—even should the Chinese be able to deliver readily—hinges mostly on major technological changes in the Japanese refining industry.[48]

Chinese planners also face difficult decisions regarding the future state of small-scale technologies which have played such a critical part in the rural industrialization. Their low quality output and inordinate energy cost do not make them very suitable in more advanced stages of modernization—but their total, or near total, substitution by centralized large-scale production would not be an appropriate solution in a capital-short country so badly equipped with good roads and railways.

In modernizing the countryside, Chinese should also avoid sinking into an excessive dependence on fossil fuels: there are definitive advantages in keeping and improving certain functions of a society running on solar energy.[49] For example, energy flow analysis shows that draft animals do not put an excessive burden on the country's ecosystem and, consequently, many of them should be kept even in largely mechanized farming to contribute useful work and valuable protein and organic fertilizer. Similarly, establishment of fuelwood lots in suitable deforested regions, complete use of logging residues in forested areas, generation of biogas from animal wastes and crop residues and operation of small hydro stations provide an excellent alternative, or at least a welcome supplement, to nonrenewable fuels.

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[46] Chinese crude oil exports totaled U.S. $760 million in 1975 and $665 million in 1976; in relative terms these shipments provided only about 10.6 and 9.2 percent of China's export earnings (CIA. "China: International Trade, 1976–77" (Washington, D.C., CIA, 1977), p. 12), and their value was virtually identical with foodstuff imports in those 2 years.

[47] Both oil and coal exports will start at lower levels and will be progressively increased over the 5-year period. Crude oil shipments should reach 15 mmt in 1982, and will account for 4.9 percent of the Japanese oil consumption (as opposed to 2.6 percent in 1977). Both coking coal (5.1-5.3 mmt) and powerplant coal (3.3-3.9 mmt) will be exported (E. Lachica, "Japan Signs Pact to Buy China's Oil, Coal in Exchange for up to $11 Billion in Sales," The Wall Street Journal, vol. 58, No. 88 (Feb. 18, 1978), p. 6).

[48] Japan will remain for years the only large potential market for Chinese oil exports but Japanese oil refiners have been reluctant to import large volumes of Chinese crude because of its low gravity and very high pour point (app. F); they would like to obtain governmental financial assistance for new expensive facilities needed to process these crudes so they would yield product mix similar to the Middle Eastern oils.

[49] It would be ironic for China to discard all of her precious renewable energetics in time when the world's most industrialized nations are searching for ways to cut their dependence on fossil fuels by increasingly engaging in research and applications of solar energy—as direct radiation, crop and forest fuels, wind and ocean thermal power—for heating and electricity generation.

In sum, China's energy development strategy should be multifaceted and flexible. Taking into account the richness, location and quality of resources, ancient traditions of solar energetics and enormous regional disparities within the nation, it should strive to modernize the countryside without cutting it completely off its traditional renewable energies and without abandoning appropriate small-scale industries; it should aim for sustainable growth rates of coal and hydrocarbon production by, among others, tapping the still sizable economies of scale and introducing as many advanced foreign technologies as practicable;[50] and it should attempt to improve conversion efficiencies and encourage proper final uses and widespread conservation.[51]

Given a stable, rational government, these strategies would not only maintain China's energy self-sufficiency for the remainder of this century, but would even allow for modest growth of fuel exports. They would also firmly establish China as the world's third largest economy and might bring a modicum of prosperity to her vast population.

Appendix A. Units and Their Equivalents

Abbreviations	Units	Equivalents
bm^3	billion cubic meters	35.31×10^9 cubic feet.
bmt	billion metric tons	10^{12} kg; 2.205×10^{12} pounds; 1.1×10^9 short tons.
Btu	British thermal unit	0.252 kcal; 1,055 J.
°C	degree Celsius	(°C/5)*9+32 °Fahrenheit.
cm^2	square centimeter	10^{-4} square meter; 0.155 square inch.
GW	gigawatt	10^9 W; 1.341×10^6 hp .
hp	horsepower	745.7 W; 10.68 kcal/min.; 42.44 Btu/min.
J	joule	2.389×10^{-4} kcal; 9.486×10^{-4} Btu.
kcal	kilocalorie	10^3 calories; 3.968 Btu; 4, 183 J.
kg	kilogram	10^3 grams; 2.2046 pounds.
kgce	kilogram of coal equivalent	7,000 kcal; 27,776 Btu; 29.28×10^6 J.
km	kilometer	10^3 meters; 0.6214 statute mile.
kW	kilowatt	10^3 W; 14.34 kcal/min.; 1.341 hp.
kWh	kilowatt hour	860.5 kcal; 3,413 Btu; 3.6×10^6 J.
m^3	cubic meter	35.31 cubic feet; 1.308 cubic yards.
mmt	million metric tons	10^9 kg; 2.205×10^9 pounds; 1.1×10^6 short tons.
mmtce	million metric tons of coal equivalent	7×10^{12} kcal; 2.77×10^{13} Btu; 2.928×10^{16} J.
MW	megawatt	10^6 W; 1.341 hp.
W	watt	0.01433 kcal/min.; 0.05688 Btu/min.

Appendix B. Derivation of the Rural Energy Flows

Rural Energy Flow Graph

General system flow graph is constructed in H. T. Odum's energy circuit language which is a very suitable tool for such applications: for the introduction into the modules of the language see H. T. Odum, *Environment, Power, and Society* (New York, Wiley-Interscience, 1971), pp. 37–39; the most detailed explanation of the physical basis of the energy circuit language is given in H. T. Odum, "An Energy Circuit Language for Ecological and Social Systems: Its Physical Basis" in B. C. Patten, Ed., *Systems Analysis and Simulation in Ecology*, Vol. II, (New York, Academic Press, 1972), pp. 139–211.

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[50] Perhaps the only exception should be nuclear energetics. Although the Chinese believe that nuclear power has "outstanding merits" and is a safe and clean source of energy (Feng Tse-chun, "Nuclear Power", K'o-hsueh Shih-yen, No. 12 (December 1976), pp. 29–31), introduction of commercial fission generation in the near future could be hardly justified as necessary or economical.

[51] This will require a major move away from inefficient and polluting household coal combustion in large northeastern and northern cities to liquid fuels and natural or liquified petroleum gases, a transformation already underway in several large centers (Peking, Tientsin, Shenyang, Anshan). Another low efficiency use of coal to be substituted by liquid fuel is in railway transportation.

Insolation

Annual radiation with cloudless sky according to M. I. Budyko, *Climate and Life* (New York, Academic Press, 1974), pp. 46–47; total insolation calculated as the product of China's land mass (95.61×10^{15} cm^2 without Taiwan) and the average cloudless sky radiation of 209.4 kcal/cm^2/year. For details on radiation obstructions in China see I. E. M. Watts, "Climates of China and Korea" in H. Arakawa, Ed., *Climates of Northern and Eastern Asia* (Amsterdam, Elsevier, 1969), pp. 41–43. Actual annual radiation was obtained by multiplying the country's area by the average insolation of 120 kcal/cm^2/year; for a map of annual solar inflow see Akademiya Nauk SSSR, *Fiziko-geograficheskii atlas mira* (Moscow, Akademiya Nauk, 1964), p. 22. Due to the inadequacy of available data the final figure must be seen as a mere approximation of the right order of magnitude.

A Chinese source (*K'o-hsueh Shih-yen*, No. 10 (1974), p. 31) claimed that the solar energy received by China is equivalent to 100,000 generating plants with 12,000,000 kW capacity: this estimate translates to only 9×10^{18} kcal per year (1.2×10^{12} kW $\times 8.7666 \times 10^3$ hours $= 10.5193 \times 10^{15}$ kWh). For comparison, the total amount of solar energy received annually by the contiguous United States (the area $-$ 95.2×10^{15} cm^2 — is almost identical to that of the PRC) is between $13\text{–}13.5 \times 10^{18}$ kcal. For detailed maps of the United States insolation see U.S. Department of Interior, *The National Atlas of the United States of America* (Washington, D.C., USGPO, 1970), p. 93.

Phytomass Production

Net primary production is the rate of storage of energy in plant tissues in excess of the respriatory utilization by the plants and its average values and caloric equivalents for major vegetation units are taken from H. Lieth, "Primary Production of the Major Vegetation Units of the World" in H. Lieth and R. H. Whittaker, Eds., *Primary Productivity of the Biosphere* (New York, Springer-Verlag, 1975), p. 205. Area totals are based on figures in Ministry of Agriculture of the PRC, *Fundamentals of Agricultural Production Techniques* (Shanghai, Ministry of Agriculture, 1965), partial English translation in *JPRS*, No. 61746 (15 April 1974), p. 4; S. D. Richardson, *Forestry in Communist China* (Baltimore, Johns Hopkins Press, 1966), pp. 159–161 and FAO, *Production Yearbook 1974* (Rome, FAO, 1975), p. 5. For details on crop production and energy equivalents see V. Smil, "Food Availability in Communist China: 1957 and 1974", *Issues and Studies*, Vol. 13, No. 5 (May 1977), pp. 39–57. Average by-product multipliers (1.6 for rice, 1.5 for other cereals, 0.2 for sweet and 0.3 for white potatoes and sugar cane, 2.0 for soybeans and peanuts, 1.2 for other legumes, 0.3 for vegetables and 3.0 for cotton) are based on a large number of figures collected by J. L. Buck, *Land Utilization in China* (Nanking, University of Nanking, 1937), p. 229; O. L. Dawson, *Communist China's Agriculture* (New York, Praeger, 1970), p. 183; and A. Poole, "The Potential for Energy Recovery from Organic Waste" in R. H. Williams, Ed., *The Energy Conservation Papers* (Cambridge, Mass., Ballinger, 1975), p. 288. Proportion of roots in total net primary crop production is an average based on data in R. H. Whittaker and P. L. Marks, "Methods of Assessing Terrestrial Productivity" in H. Lieth and R. H. Whittaker, Eds., *op. cit.*, pp. 92–94.

Domestic Animals

Animal totals used for calculating the feed requirements, work and waste output are from FAO, *op. cit.*, pp. 193–204; USDA (in its annual *Agricultural Statistics*) and CIA (in its annual *China: Economic Indicators*) offer only slightly different estimates. Total daily feed consumption (in kg of dry matter) is assumed to average 4.5 for large animals, 1.5 for goats and sheep, 2.0 for pigs and 0.1 for poultry; these are representative values according to P. L. Altman and D. S. Dittmer, Eds., *Biology Data Book* (Bethesda, Federation of American Societies for Experimental Biology, 1974), Vol. III, pp. 1451–1458. Roughage shares, according to Dawson, *op. cit.*, pp. 181–182, are (in percent) 80 for large animals, 95 for goats and sheep and 85 for pigs. Grazing, hay and feed weeds are assumed to supply slightly more than one half of roughage requirements (about 900×10^{12} kcal) with the rest (800×10^{12} kcal) coming from crop by-products. Concentrates come predominantly (75 percent, or some 230×10^{12} kcal) from crop processing residues and the remainder is feed grain, legumes and potatoes (about 70×10^{12} kcal). For calculation of animal work average weights are derived from extensive data collected by H. Epstein, *Domestic Animals of China* (Farnham Royal, Commonwealth Agricultural Bureaux, 1969), *passim* and from figures published by the Ministry of Agriculture of the PRC, *op. cit.*, p. 227. Average draft is assumed to equal 10 percent of body weight in cattle, buffaloes and asses and 15 percent in horses and mules (H. J. Hopfen, *Farm Implements for Arid and Tropical Regions* (Rome, FAO, 1969), p. 9). Average work speed is according to Hopfen, *op. cit.*, p. 10; Ministry of Agriculture of the PRC, *op. cit.*, p. 229, and W. R. Cockrill, *The Buffaloes of China* (Rome, FAO, 1976), pp. 38–39. Number of hours worked annually is based on figures in O. L. Dawson, *op. cit.*, p. 177, and W. R. Cockrill, *loc. cit.* Two-thirds of draft animals are assumed to be available for work, the mean value of figures given by Dawson, *loc. cit.*, and K. R. Walker, "Organization of Agricultural Production" in A. Eckstein, W. Galenson and Ta-chung Liu, Eds., *Economic Trends in Communist China* (Chicago, Aldine, 1968), p. 417.

To calculate animal wastes, the following output averages (in kg of fresh manure/head/year) are assumed: 5,000 for large animals, 500 for goats and sheep, 2,000 for pigs and 15 for poultry. Dry solids—about 20 percent of large animal and pig manure, 30 percent of goat and sheep manure and 40 percent of poultry wastes—have energy value around 3,000 kcal/kg and it is assumed that 70 percent of all large animal and pig manure and 25 percent of poultry wastes—a total of nearly 130 million dry tons or 380×10^{12} kcal—is available for recycling. All assumptions used for calculating animal wastes are taken from K. Chao, *Agricultural Production in Communist China 1949–1965* (Madison, University of Wisconsin Press, 1970), pp. 145, 312–313, and L. J. Fry, *Practical Building of Methane Power Plants for Rural Energy Independence* (Santa Barbara, Standard Printing, 1974), pp. 39–40. Conservative nature of the assumptions is well illustrated by a recent Chinese claim (in "Expanding Sources of Fertilizer and Using it Rationally", *China Reconstructs*, Vol. 26, No. 7 (June 1977), p. 19) that pig manure, the biggest source of organic fertilizer in the country, is produced at an average rate of 3 tons/animal/year, rather than 2 tons as assumed in my calculations.

Human Energetics

Food balance sheet for China in 1974, and all the assumptions underlying its construction, can be found in V. Smil, "Food Availability in Communist China: 1957 and 1974", *op. cit.* and V. Smil, "Food Energy in China", *Current Scene*, Vol. 15, Nos. 6–7 (June–July, 1977), pp. 1–11. Population figures are from L. A. Orleans, *China's Birth Rate, Death Rate, and Population Growth: Another Perspective* (Washington, D.C., USGPO, 1977), p. 31 and from the intermediate model of J. S. Aird, Foreign Demographic Analysis Division, Bureau of the Census (personal communication); age-sex distribution by single year used for caloric requirements calculation is also taken from Aird's Model 2. Average adult body weights are according to the Chinese Academy of Medical Science, cited in R. O. Whyte, *Rural Nutrition in China* (Hong Kong, Oxford University Press, 1972), p. 34; other weights are derived by ten percent reduction of comparable values of Harvard-Iowa age-weight tables in W. F. Nelson, Ed., *Textbook of Pediatrics* (Philadelphia, Saunders, 1964), pp. 48–53. Methodology of estimation of energy requirements at the national level is presented in Report of a Joint FAO/WHO *Ad Hoc* Expert Committee, *Energy and Protein Requirements* (Geneva, WHO, 1973), pp. 78–84. Energy expenditures in various human activities are collected in J.V.G.A. Durnin and R. Passmore, *Energy, Work and Leisure* (London, Heinemann Educational Books, 1967). Totals and shares of the rural work force participating in off-season projects are from various NCNA releases and provincial broadcasts in *SWB*, FE/W759/A/1–3 (23 January 1974); FE/W806/A/2–7 (18 December 1974); FE/W815/A/7–13 (26 February 1975) and from "Farmland Capital Construction Achievements in PRC in Last 5 Years", *Ching-chi Tao-pao* (14 April 1976), p. 20, English translation in *JPRS*, No. 67649 (26 July 1976), pp. 24–26.

Calculation of useful energy expenditures can be done either by multiplying a reasonable estimate of work rate (6 and 5 kilogram-meters for a continuous effort of the Chinese men and women) by the total number of work hours (2,400 per year) to yield 100,000–120,000 kcal/person; or to assume all day energetic efficiency about 15 percent for 8 hours of work for a total of 97,000–130,000 kcal/person; or to determine it, according to the Report of a Joint FAO/WHO *Ad Hoc* Expert Committee, *op. cit.*, p. 38, as the residual after subtracting maintenance energy cost (about 1.5 times basal metabolic rate for a given weight) from an average food intake for an average result of 92,000 kcal/person. Calculation of recycled human waste is based on the following assumptions; daily average of 0.15 kg/person of dry waste, mid-year population of 917 million, 66 percent availability of the waste and five percent nitrogen content.

Traditional Fuels

Forest fuel (this, rather than fuelwood, is the proper term as the Chinese burn not only woody stem tissues but also branches, bark, stump wood, shrubs, leaves and grasses) consumption of 140 million m^3 in 1974 is determined as follows: 60 percent of forested area (i.e. 2.5×10^{15} kcal of phytomass) is assumed to be accessible (this is the average FAO accessibility estimate for the Far East: FAO, *World Forest Inventory 1958* (Rome, FAO, 1960), p. 66; Richardson, *op. cit.*, p. 14, was told by the Chinese foresters that 75 percent of the total resource will be eventually accessible) and at least 15 percent of the accessible increment—some 380×10^{12} kcal—is harvested annually (this is a conservative estimate as the global average calculated from the estimates on K. Openshaw, Division of Forestry, University of Dar es Salaam, is at least 17 percent—and very likely much higher). Average energy content of one kg of air dry wood is 3,700 kcal (assuming 20 percent moisture and the absolutely dry value of 4,700 kcal/kg) and one m^3 of fuelwood has the mass of 725 kg (FAO, *Yearbook of Forest Products 1961–1972* (Rome, FAO, 1974), p. LX). Energy equivalent of timber was calculated by applying the same conversion factors to the CIA estimate of 35.154 million m^3 (CIA, *China: Economic Indicators* (Washington, D.C., CIA, 1977), p. 23. The amount of crop by-products used as fuel was obtained as the residual after accounting for other uses: 900×10^{12} kcal for feed, and bedding, about 10 percent (200×10^{12} kcal) for various household and industrial uses (approximately the proportion found in surveys by J. L. Buck, *op. cit.*, p. 238), and at least 5 percent (about 100×10^{12} kcal) subtracted for waste.

APPENDIX C. CHINA'S PRIMARY ENERGY PRODUCTION

TABLE C-1.—CHINA: PRODUCTION OF PRIMARY ENERGY, 1949–77

	Coal [1] (millions of metric tons)			Crude oil [2] (millions of metric tons)	Natural gas [3] (billions of cubic meters)	Hydroelectricity [4] (billions of kilowatt-hours)
	Total	Large mines	Small mines			
1949	32.43	22.12	10.31	0.12	0	0.70
1950	42.92	32.61	10.31	.20	0	.80
1951	53.09	45.41	7.68	.31	0	1.00
1952	66.49	56.18	10.31	.44	0	1.30
1953	69.68	61.53	8.15	.62	.01	1.50
1954	83.66	75.55	8.11	.79	.01	2.20
1955	98.30	89.65	8.65	.97	.11	2.40
1956	110.36	101.86	8.50	1.16	.23	3.50
1957	130.73	123.23	7.50	1.46	.33	4.70
1958	230.00	178.66	51.34	2.26	.94	5.50
1959	300.00	234.00	66.00	3.70	1.42	7.80
1960	280.00	214.00	66.00	5.10	1.98	9.00
1961	170.00	144.00	26.00	5.19	2.83	8.00
1962	180.00	154.00	26.00	5.75	3.27	6.00
1963	190.00	162.00	28.00	6.36	5.66	6.00
1964	204.00	174.00	30.00	8.65	10.90	7.00
1965	220.00	187.00	33.00	10.96	11.32	9.00
1966	248.00	210.00	38.00	14.07	11.01	10.00
1967	190.00	155.00	35.00	13.90	10.47	10.00
1968	205.00	165.00	40.00	15.20	11.32	12.00
1969	258.00	200.00	58.00	20.38	12.70	15.00
1970	310.00	235.00	75.00	28.21	16.00	18.00
1971	335.00	250.00	85.00	36.70	20.00	21.00
1972	356.00	260.00	96.00	43.07	24.50	23.00
1973	377.00	271.00	106.00	54.80	30.60	25.00
1974	384.00	279.00	110.00	65.77	35.00	27.00
1975	427.00	307.00	120.00	74.26	39.80	30.00
1976	448.00	300.00	148.00	83.61	45.00	33.00
1977	494.00	331.00	163.00	90.30	55.00	34.00

[1] Total coal production: 1949–76—CIA, "China: Economic Indicators," op. cit., p. 20; 1977—coal production up 10.2 percent in the 1st 11 mo of 1977 compared with the same period in 1976 ("Initial Success in Economic Construction," Peking Review, vol. 21, No. 2 (Jan. 13, 1978), p. 12). Large and small mines: 1949–56 and 1965–76—CIA, "China: Economic Indicators," loc. cit.; 1957–64—V. Smil, "China's Energy," op. cit., p. 18 (for slightly different estimates of coal output from large mines during this period see CIA, "People's Republic of China: Timber Production and End Uses," op. cit., p. 21); 1977—assuming the same shares of output as in 1976.

[2] Crude oil production: 1949–76—CIA, "China: Economic Indicators," loc. cit., 1977—"Initial Success in Economic Construction," loc. cit. claimed 8 percent increase for January–November 1977.

[3] Natural gas: 1949–74—V. Smil, "China's Energy," op. cit., p. 138; 1975–76—V. Smil, "China's Energy Performance," Current History, vol. 73, No. 429, 1977, p. 67; 1977—according to "Initial Success in Economic Construction," loc. cit., January–November production was up by 22.3 percent.

[4] Hydroelectricity: 1949–75—CIA, "China: Economic Indicators," loc. cit.; 1976—assuming increase slightly over 9 percent (the average increment in 1971–75); 1977—assuming only a very modest increment (about 3 percent) due to the extreme drought in many areas of China.

APPENDIX D. CONVERSION FACTORS

Conversion of different fuels and primary electricity (hydro, nuclear and geothermal) to a common denominator is necessary to express the aggregate values of energy production and consumption and to enable international comparisons. Scientific unit of choice is, of course, Joule; calories and British thermal units are also often used. However, preferred international statistical methods are to convert individual outputs or inputs into coal or oil equivalents. UNO, in its *World Energy Supplies* series, has been using hard coal equivalents, while OECD statistics are calculated in terms of oil equivalent.

In converting fossil fuels to hard coal equivalent, 1,000 m^3 of natural gas are always assumed to equal 1.332 ton of coal—but crude oil consumption is multiplied by values anywhere between 1.3–1.5. The highest value, preferred by the CIA, expresses the full energy content of crude oil, while the lowest figure reflects both the refining losses and non-energy uses of refined oil products. UNO had been converting with the factor of 1.3 until 1976 when it switched to 1.47. I have been consistently using 1.3.

In the Chinese case, it is the conversion of coal which presents the greatest difficulty as the country's output has never been given in uniform terms but always as a mixture of unknown (or at least very uncertain) proportions of raw and dressed coal, with low quality unsorted small mine production further complicating the the conversion task. UNO, without apparently ever noticing these facts, keeps on treating the Chinese coal output on 1:1 basis; CIA favors 0.8 for the better large coal mine production and 0.6 for small mine output.

The last reliable conversion figures for the Chinese raw coal output are for the years 1953–1957 when the average was 0.714. During that period low quality small mine output accounted for only five percent of the total—while today it provides one-third of the total production. Consequently, I have been converting coal values at more conservative rates of 0.7 for the large and 0.5 for the small mine production.

Depending on the multiplier used, the identical mass (or volume) output (or consumption) figures can be turned into rather widely differing energy equivalents. For example, the Chinese 1976 production of about 450 mmt of raw coal (300 mmt in large, 150 mmt in small mines) translates into the identical total of coal equivalent tons in the UNO statistics (an absolutely unrealistic exaggeration), equals 330 mmtce according to the CIA, and totals only 285 mmtce in my calculations. These differences, as well as those pertaining to the crude oil conversions, must be kept in mind when comparing coal equivalent production or consumption series prepared by various authors or institutions.

APPENDIX E. DERIVATION OF COMMERCIAL ENERGY FLOW PATTERN

For primary energy inputs by source and sector I have used my previous estimates (for their derivation see V. Smil, *China's Energy, op. cit.*, pp. 146–149). Non-energy uses (chemical feedstocks, lubricants, asphalts, etc.) were assumed to be 25 percent of the total industrial consumption for natural gas, eight percent of the total crude oil and one percent of the total raw coal inputs.

Efficiency multipliers to calculate the useful energy flows were as follows: Electricity generation (including transmission losses) 0.33; households and commerce: electricity 0.05, natural gas 0.5, refined oil products 0.4, coal 0.3; agriculture: electricity 0.6, refined oil products 0.5, coal 0.3; industry: electricity 0.7, natural gas 0.6, crude oil and refined products 0.5, coal 0.33; transportation: refined oil products 0.2, coal 0.09.

These first-law efficiencies (energy transfer of desired kind achieved by a device or system/energy input to the device or system) were derived by moderate reduction of representative Western values given in American Physical Society, *Efficient Use of Energy* (New York, American Institute of Physics, 1975), pp. 25–51; C. Starr, "Energy and Power", *Scientific American*, Vol. 224, No. 3 (September 1971), p. 40; C. M. Summers, "The Conversion of Energy", *ibid.*, p. 97; C. A. Berg, "Conservation in Industry", *Science*, Vol. 184, No. 4134 (19 April 1974), pp. 264–270.

APPENDIX F. CRUDE OIL CHARACTERISTICS

Crude oil gravity (measured in degress of American Petroleum Institute—°API—which are inversely related to specific gravity), pour point (the lowest temperature at which an oil could be stored or handled without congealing in the tanks or pipelines) and sulfur content (expressed in percent of the total weight) are the three most essential characteristics used to compare crude oils. Ta-ch'ing oil has very low sulfur content, matching, in this respect, the highly prized Algerian and Nigerian crudes; Sheng-li crude, though more sulfurous, is still "sweeter" than are typical Saudi Arabian and Iranian oils.

However, high paraffinic content of the Chinese oils—as much as 22.4 percent by weight for Ta-ch'ing crude—results in very high viscosities and unusually high pour points; among the world's important export oil streams only Indonesian Minas crude has comparably undesirable characteristics which complicate all forms of transportation and storage. Product yield of the Chinese crudes is also unfavorable: during straight distillation lighter fractions (final cut up to 650° F) amount to 30.1 percent in Ta-ch'ing oil, while they are, respectively, 43.6 and 52.3 for Saudi Arabian heavy and light oils and 50.1 and 52.7 for their Iranian counterparts ("Guide to World Crudes 1", *The Oil and Gas Journal*, Vol. 74, No. 13 (29 March 1976), pp. 98–122). More sophisticated cracking systems are thus necessary to refine the large volume of residue (68 percent for Ta-ch'ing crude, including nearly 29 percent of asphalt, and 77.1 percent for Sheng-li oil).

TABLE F-1.—CHARACTERISTICS OF TA-CH'ING AND SHENG-LI CRUDES IN COMPARISON WITH MAJOR WORLD OIL EXPORT STREAMS[1]

Designation of crude stream: Producing country	Gravity API	Pour point °C	Percent sulfur
Ta-ch'ing: China	33.0	+35.0	0.14
Sheng-li: China	24.6	+27.5	.88–1.35
Arabian heavy: Saudi Arabia	28.2	−34.0	2.84
Arabian light: Saudi Arabia	33.4	−34.0	1.80
Iranian heavy: Iran	30.8	−21.0	1.60
Iranian light: Iran	33.5	−29.0	1.40
Kuwait: Kuwait	31.2	−18.0	2.50
Kirkuk: Iraq	35.9	−36.0	1.95
Brega: Libya	40.4	−1.0	.21
Hassi Messaoud: Algeria	44.0	−24.0	.14
Benny light: Nigeria	37.6	+2.0	.13
Minas: Indonesia	35.2	+32.0	.09
Tyumen: U.S.S.R.	34.0	−20.0	.97

[1] "Guide to World Crude Oil Export Streams," Oil & Gas Journal, vol. 74, No. 13 (Mar. 29, 1976), special fold-out chart; Meyerhoff and Willums, op. cit., p. 180.

CHINA'S MINERAL ECONOMY

By K. P. Wang

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BACKGROUND

According to the World Bank, China's average annual real economic growth at just over 5 percent during 1970–75 was even larger than that of Japan; and Chinese resources played a significant role in this growth. The country is clearly thinking about expanding international trade, judging from the $20 billion deal signed with Japan in February 1978 which has an important component of exporting Chinese fuels for Japanese industrial plants and know-how. China was also starting to expand trade with Western Europe along similar lines. However, Chinese trade with the United States, after a brief flourish in 1975, was still relatively small as of early 1978.

Mineral developments in the People's Republic of China (PRC), especially in petroleum and steel, have been increasingly in the news. Oil and gas have great potential, and a very large coal industry similar in magnitude to those of the United States and the Soviet Union is already in existence. The steel industry ranks about fifth or sixth in the world, and additional integrated facilities capable of producing 12 to 15 million metric tons per year (mtpy) are planned to be built in the next few years with Japanese assistance. The PRC is also prominent in fertilizers, cement, and salt. Its strategic "export metals" tungsten, antimony, and tin are very well known in United States and world markets. Thirteen large fertilizer plants built with foreign technology were either completed by early 1978 or nearing completion. The country was buying heavily in nonferrous metals a few years back and to meet sharply growing needs, probably will be turning in part to developing local primary production or building smelter-refineries with international know-how. There have also been many recent reports about major mineral discoveries and development of new mines and oil and gasfields.

The subject of mineral economics covers a wide spectrum of resource and industrial activity, from geology and exploration to mineral rights of land and sea, mining, metallurgy, and mineral processing, and in terms of not only production but also consumption, supply, transport, and development policies. For example, the steel and cement industries would operate not only the steelworks and manufacturing plants and often also enterprises producing iron ore, limestone, shale, refractories, and other metals and nonmetallics as well. Even nuclear and space activities are related not only to technical sophistication but also to raw materials like radioactive minerals and rare earths and metals. Moreover, consumption and trade of mineral, metal, and fuel products may have important economic and strategic implications.

For most countries with relatively high levels of economic activity, output of minerals and fuels may be only 1 to 5 percent of the GNP whereas production of finished mineral and metal products when including value added would be closer to 10 to 20 percent of the GNP. China is no exception. The Chinese, in realizing that resources and their availability are fundamental to industrialization and perhaps also to trade, have placed great emphasis in this general area. It is therefore pertinent to examine the many factors affecting China's mineral enterprise, such as the extent of geological knowledge, the world significance of its resources, human and natural factors influencing development and production, economic geography and transport, implications of international trade, and efforts to acquire technologies from advanced countries.

With no firsthand information and little in the way of literature reviews, it is difficult to determine specific activity levels for China. This is understandable, in view of the general record of centrally-controlled economies. However, because many PRC minerals are significant by world standards, considerable fragmentary data and evaluations are available through commercial circles, technical journals, international trade publications, Japanese sources, visitors, analysts, government sources, general literature, and the press of the PRC itself. Photographs from PRC newspapers and periodicals and foreign visitors also reveal interesting technical and commercial information. The situation becomes more apparent when appraised by long-time observers of Chinese mineral developments who have a strong earth science background. An attempt has been made here to tell the mineral story of China in the best way possible. Accuracy of estimates vary with the individual industry, depending upon how much the subject has been officially reported surveyed, or studied. Nonetheless, the magnitude of production levels seem clear and accuracy should improve in the years ahead.

Actual reporting of national output by the PRC has been rare indeed. Oil figures have been given intermittently for nearly two decades, but not during politically-troubled years and very recently. Some steel figures were mentioned a few years back. Informally, the Chinese have given out some overall oil, coal, and steel statistics for 1976 and 1977, although the information surely needs to be confirmed. Of late, the Chinese have reported a little more on individual mines, facilities, enterprises, and provinces for the basic mineral industries.

Better knowledge of major components of such industries provide a strong basis for making reasonable estimates. For example, principal facilities of China's leading steelworks are fairly well known, especially Anshan, Peking, and Wuhan. Most of the large coal combines producing 5 to 25 million tpy can be enumerated; and estimates can also be made for the medium-sized mines and the small mine sector. The majority of the large cement plants are also known, and the Chinese say that their small cement plant sector provides just over half of the national output. Actual production data for specific oilfields have never been reported. Adding up individual enterprises or provinces is a much better methodology for making estimates than purely relying on percentage changes which can be quite erroneous. All the lesser mineral industries are surrounded in secrecy quantitatively, particularly the nonferrous metals which the Chinese call "colored metals." Nonetheless, even in these areas, much more is known through the eyes of the expert who looks into the background of the industries, keeps close touch with the trade circles, and consults foreign literature and visitors.

For those who wish to pursue the subject of Chinese minerals further, it is believed that a book by the author entitled "Mineral Resources and Basic Industries of the People's Republic of China" (Westview Press, Boulder, Colo., 1977) and an article on China's mineral industries by the author in the forthcoming 1978 Annual Review Issue of the London Mining Journal might prove to be rather useful. Overall studies of this subject are rare, because of the lack of dependable specific data. For example, a recent "microfiche" book on "Mineral Resources of China" by A. B. Ikonnikov published by the Geological Society of America does not have much data beyond the early 1960's. A number of books and many reports have been written on Chinese oil and energy, but most of these have not been authoritative on individual fields and operations. Oil developments are certainly occurring fairly rapidly, particularly with regard to new areas, facilities, and marketing arrangements. Oil journals in the United States, Europe, and Japan (particularly Japan Petroleum and Energy Weekly) give a good running account of happenings. The British Colliery Guardian and the U.S. publication World Coal keep up pretty well on the Chinese coal situation. The Japan Metal Bulletin published three times weekly in Tokyo has much news on the China scene, particularly on the progress of the Chinese metallurgical industry and Sino-Japanese mineral trade. The Metals Week by McGraw Hill often has data on China's metal trade and developments. The British Sulphur Corp. covers the Chinese fertilizer situation very well. A few United States studies on the Chinese steel industry are getting out of date, since this industry is expected to forge ahead rapidly in the next decade. Takungpao and secondarily the Jen-Min Jih-Pao are among the best Chinese sources of information on up-to-date developments. Many individuals in the United States and abroad know specific aspects of the Chinese mineral economy and these people, along with knowledgeable representatives of the trade circles and industry, should be consulted in any comprehensive evaluations. The National Foreign Assessment Center of the U.S. Government has issued various useful reports on individual sectors of the Chinese mineral economy.

INTRODUCTION [1, 2, 3]

A remarkable industrial renaissance is underway in the People's Republic of China (PRC). All indications are that this industrial progress will continue and possible accelerate. The long history of mining and metallurgy in China and the extensive resources have been significant factors in bringing the PRC prominence not only in industrialization but in world affairs as well.

Development of the rich mineral resources, a matter of top priority since the establishment of the People's Republic of China, has been basic toward achieving the twin and interrelated objectives of furthering agriculture and advancing industry. An industrious and disciplined population has been successfully mobilized to work the land efficiently, harness the waters, uncover and extract the resources, and produce the necessary goods and services. Much more can be accomplished, but there is no question that the Chinese are already enjoying improved living standards.

"Walking on two legs" has been a fundamental policy to simultaneously develop both large and small industries, which creates localized economic strength, cuts down on transportation requirements, and enables industry to better serve agriculture. The Chinese know that small-scale operations can also be worked efficiently. Since 1971, a new factor has entered Chinese industrial planning, which is the concept of dispersing industry for strategic reasons.

China's total gross national product (GNP) has reached the respectable level of over $320 billion in 1977, placing the PRC solidly within the first 10 by world standards. Per capita GNP in the PRC is not precisely comparable with the GNP in Western nations. Because the Chinese yuan (Ren Min Bi, or RMB, valued at about $0.60) goes further in China than Western currencies elsewhere owing to lower food, lodging, and transportation expenses, the country's economic strength is really greater than indicated. PRC's GNP has been growing at an annual rate of up to 10 percent in recent years, although much less in 1976 when both Mao Tse-Tung and Chou En-Lai passed from the political scene.[4]

During the Fourth National People's Congress held in the second half of January 1975, PRC's twin long-term development goals were stated as follows: (1) Before 1980, China should have established a relatively independent and integrated industrial system, and (2) before the end of this century, China should become a totally up-to-date modern power.

On February 26, 1978, Chairman Hua Kuo-Feng unveiled an 8-year economic program that calls for the development of 120 large-scale projects, including 10 iron and steel complexes, 9 nonferrous metal complexes, 8 coal combines, 10 oil and gas fields, 30 power stations, 6 new trunk railways, and 5 key harbors aimed at "changing the backward state of our basic industries." [5]

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[1] See Wang, K. P., "Mineral Resources and Basic Industries of the People's Republic of China," West View Press, Boulder, Colo., May 1977, 211 pp.

[2] See Wang, K. P., "Mineral Industries of the People's Republic of China." U.S. Bureau of Mines. Mineral Perspectives MP-3. 1977, 8 pp.

[3] See Wang, K. P., "The People's Republic of China—A New Industrial Power With a Strong Mineral Base." U.S. Bureau of Mines. 1975. 96 pp.

[4] See Far Eastern Economic Review (Hong Kong). Asia 1978 Yearbook, p. 159–169.

[5] Asia Wall Street Journal (Hong Kong). March 7, 1978, p. 1 and p. 6.

World Significance

China is one of the world's rich mineral areas fully capable of supporting a modern first-rank industrial economy. During 1977, PRC strengthened its position as a leading mineral producer. Its relative importance should grow significantly in the decade ahead, judging from the resource potential and the many developments already underway. As befits a large country with a huge population, China produces a great variety of minerals and metals—many outstanding by world standards. If all minerals were added together in terms of output value, PRC would rank with the world's first five for crude minerals and only a little behind in terms of total value added for minerals and metals. How China compares with major world producers of minerals and metals is shown in table 1.

TABLE 1.—MAJOR WORLD PRODUCERS OF MINERALS AND METALS, 1976

Country [1]	United States	U.S.S.R.	Japan	West Germany	Canada	Australia	China [2] (estimate)
Hard coal (million tons)	600	[3] 540	[4] 20	[4] 90	25	75	500
Lignite (million tons)	23	[3] 170	(*)	135	(*)	31	Small
Crude oil (million tons) [5]	400	520	1	6	66	20	[6] 100
Natural gas (billion cubic centimeters)	565	321	(*)	(*)	87	6	95
Iron ore (million tons)	85	239	1	2	57	93	65
Steel ingot (million tons)	116	145	107	42	13	8	[6] 30
Primary aluminum (thousand tons)	4,000	[7] 1,600	920	700	630	230	250
Refined copper (thousand tons)	1,715	[7] 1,000	865	445	510	189	150
Cement (million tons)	67	124	69	34	5	5	40
Salt (million tons)	40	[7] 14	10	8	6	5	35

* Insignificant.

[1] The United States, the Soviet Union, and China are both large producers and consumers of minerals. Japan and West Germany must import massive tonnages of mineral raw materials for their requirements, whereas Canada and Australia are primarily exporters of minerals.

[2] Estimates are for 1977. China had a particularly bad year in 1976, because of political problems and earthquakes.

[3] Estimate, raw.

[4] Japan imported 61,000,000 tons of hard coal in 1976, and West Germany 6,000,000 tons.

[5] In addition, United States produced about 80,000,000 tons of natural gas liquids in 1976, while importing sizable tonnages of crude also. Japan imported 230,000,000 tons of crude oil in 1976, and West Germany 98,000,000 tons.

[6] Estimated capacity at yearend 1977.

[7] Estimate.

Note: Data of production table above in metric tons unless otherwise noted. West Germany denotes Federal Republic of Germany. China denotes People's Republic of China.

The coal production of PRC is nearly on a par with those of the United States and the U.S.S.R., and China's extensive coal reserves are capable of supporting a much expanded output. China has some of the world's largest coal bases; about 10 produce more than 10 million tons annually, with Kailan (Kailuan) turning out more than 20 million metric tons and 3 others—Tatung, Fuhsin, and Fushun—producing in the range of 15 to 20 million tons. Chinese oil has suddenly come into prominence, and its potential could be very great, particularly onshore in the northern coastal areas and offshore in Pohai Bay and the South China Sea. Taching is producing about 40 million tons of crude annually. Shengli and Takang probably can be stabilized at 20 million tons yearly or more, and most likely two or three other new oilfields already being developed will turn out to be of the same magnitude.

PRC's steel and cement industries, although still much behind the big three of U.S.S.R., United States, and Japan, are comparable with those of West Germany, France, Italy, and the United Kingdom. However, the steel industry may not move too fast during the remainder of the 1970's, and its only large steel base—Anshan—is barely within the world's first 20. On the other hand, the cement industry is gaining fast on the leaders. China has only four cement plants of 1 million tons annual capacity, but it has a sharply growing small-scale sector that already produces as much cement as the large plants. Overall demand for construction materials is spiraling upward.

Most of China's export metals have been famous for decades, and they are appearing more in the world markets of late. China is again the "king of tungsten," and Hsihuashan and Kiangsi are household words in wolframite trade circles. The U.S.S.R. has been the foremost buyer of Chinese tungsten in recent years. Antimony from Hsikuangshan, Hunan, dominated the world market in World War I, but uses have since changed and China now finds itself in the company of South Africa and Bolivia, with not too much money to be earned. No country can compete with Malaysia in tin, but China does well compared to the rest. Kuchiu in Yunnan is one of the tin centers of the world, and sizable quantities of high-quality Chinese tin have come to the United States in recent years. Mercury originating in Tungjen, Kweichow, has become difficult to sell in the world market, although still much in demand within China. Bismuth and manganese can be sold to whoever wants them. Molybdenum production is medium rank by world standards but could be developed.

China has been a major world factor in chemical fertilizer output, consumption, and international trade for more than 5 years. It produces about 3 million tons of nitrogen (N) annually and consumes over 4 million tons; it is by far Japan's largest customer for fertilizer. The phosphate potential is good, but output is less than one-tenth that of the United States, the world leader. The Chinese salt industry, based mainly upon coastal salt flats, is rapidly expanding; China already produces at more than four-fifths the U.S. level. PRC is prominent in pyrite. Manchuria is one of the world's best known areas for magnesite, in terms of both potential and production. China is a medium-sized producer of asbestos, graphite, barite, and fluorspar. Chinese steatite-grade talc is well known in world markets.

Mineral Supply

Like many other countries with large land areas, China is richly endowed with minerals associated with diversified geology. Fairly active exploration has greatly improved China's overall resource position in recent decades. Most prospecting done so far on hard-rock minerals has been based upon conventional concepts. However, application of the "continental collision" and lake-origin-deposition theories have resulted in major oil discoveries. Offshore oil certainly has possibilities. When the new geological concepts are applied to hard-rock minerals, significant deposits might well be discovered in hitherto unexplored areas and horizons.

China has made serious efforts to prospect, drill, and develop its rich, widespread, and diversified mineral resources (figs. 1 and 2) in accordance with national priorities. Stress has been given first to basic materials essential for industrialization, which in turn will promote agriculture. Thus, export-oriented mineral industries have not received the same degree of emphasis, except for oil, which is of fundamental importance to the economy as well as very significant in trade. Some vital but difficult-to-develop mineral industries may not have received the attention they deserved, such as nonferrous base metals. Overall, exploitation and development of Chinese minerals have been uneven.

FIGURE 1

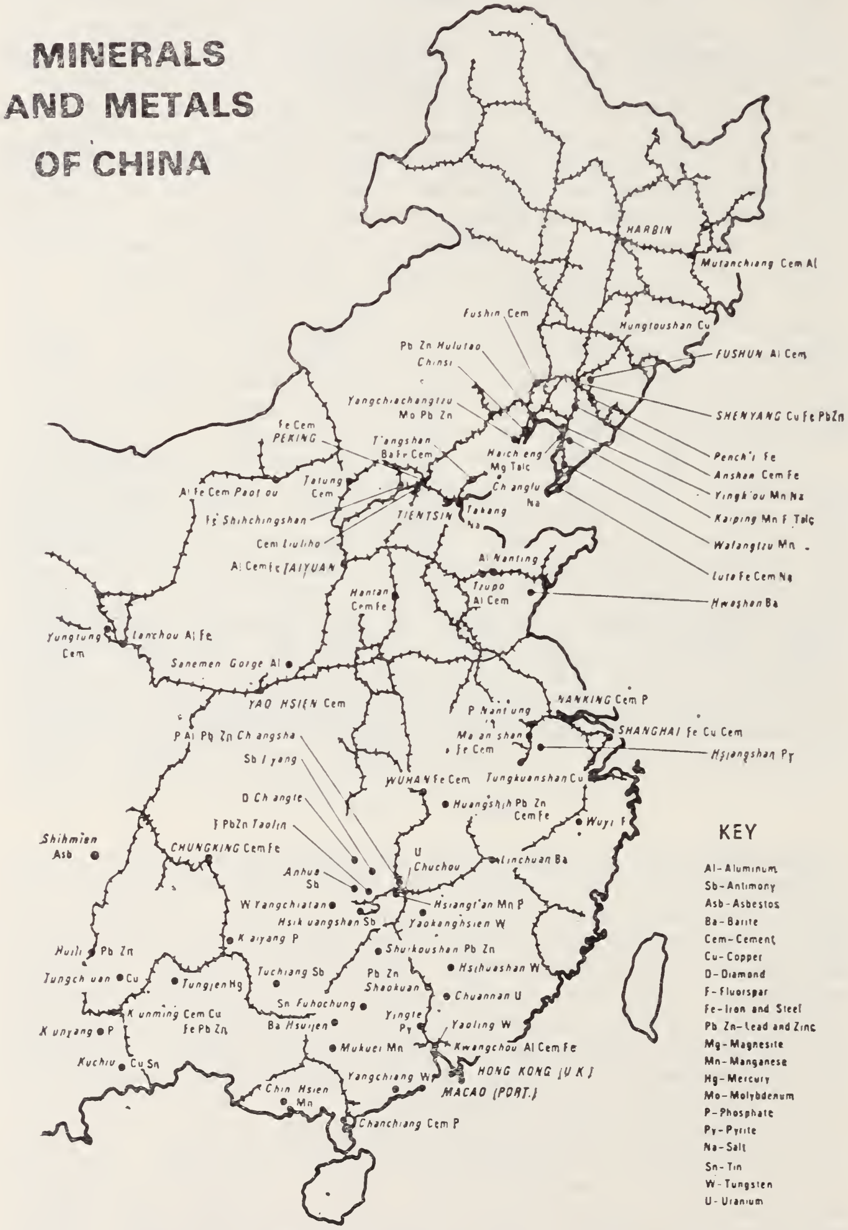
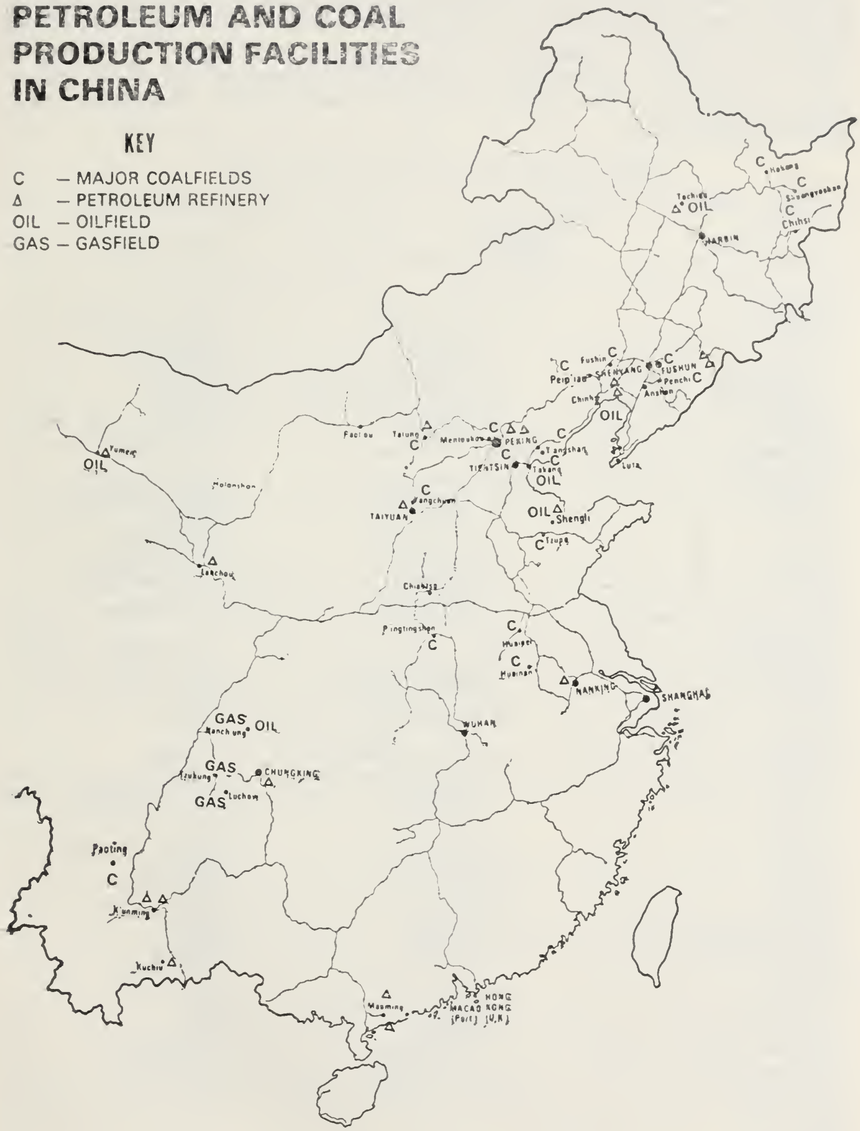

MINERALS AND METALS OF CHINA
HARBIN
Mutanchiang Cem Al
Fushin Cem
Hungtoushan Cu
Pb Zn Hulutao
Chinsi
FUSHUN Al Cem
Yangchiachangtzu
Mo Pb Zn
SHENYANG Cu Fe PbZn
Fe Cem
PEKING
T'angshan
Ba Fe Cem
Haich eng
Mg Talc
Pench'i Fe
Anshan Cem Fe
Yingk'ou Mn Na
Tatung
Cem
Ch anglu
Na
Kaiping Mn F Talc
Al Fe Cem Paot ou
Fe Shihchingshan
TIENTSIN
Tabang
Na
Walangtzu Mn
Cem Liuliho
Al Cem Fe TAIYUAN
Al Nanting
Luta Fe Cem Na
Hantan
Cem Fe
Tzupo
Al Cem
Hwashan Ba
Yungtung
Cem
Lanchou Al Fe
Sanemen Gorge Al
YAO HSIEN Cem
NANKING Cem P
P Nant ung
P Al Pb Zn Ch angsha
Ma an shan
Fe Cem
SHANGHAI Fe Cu Cem
Hsiangshan Py
Sb I yang
WUHAN Fe Cem
Tungkuanshan Cu
D Ch angte
Huangshih Pb Zn
Cem Fe
Wuyi F
F PbZn Taolin
Shihmien
Asb
CHUNGKING Cem Fe
U
Chuchou
Linchuan Ba
Anhua
Sb
W Yangchiatan
Hsiangt'an Mn P
Hsik uangshan Sb
Yaokanghsien W
K aiyang P
Huili Pb Zn
Shuikoushan Pb Zn
Hsihuashan W
Tungch uan Cu
Tungjen Hg
Tuchiang Sb
Pb Zn
Shaokuan
Chuannan U
Sn Fuhochung
K unming Cem Cu
Fe Pb Zn
Yingte
Py
Yaoling W
K unyang P
Ba Hsuijen
Mukuei Mn
Kwangchou Al Cem Fe
Kuchiu Cu Sn
HONG KONG (U K)
Yangchiang W
Chin Hsien
Mn
MACAO (PORT.)
Chanchiang Cem P
KEY
Al-Aluminum
Sb-Antimony
Asb-Asbestos
Ba-Barite
Cem-Cement
Cu-Copper
D-Diamond
F-Fluorspar
Fe-Iron and Steel
Pb Zn-Lead and Zinc
Mg-Magnesite
Mn-Manganese
Hg-Mercury
Mo-Molybdenum
P-Phosphate
Py-Pyrite
Na-Salt
Sn-Tin
W-Tungsten
U-Uranium

Figure 2


PETROLEUM AND COAL PRODUCTION FACILITIES IN CHINA
KEY
C — MAJOR COALFIELDS
Δ — PETROLEUM REFINERY
OIL — OILFIELD
GAS — GASFIELD
Hokang
Shuangyashan
Chihsi
Tachin
OIL
HARBIN
Fushin
Peipiao
SHENYANG
FUSHUN
Penchi
Anshan
Chinhsi
OIL
Luta
Yumen
OIL
Faclou
Tatung
Mentoukou
PEKING
Tangshan
TIENTSIN
Takang
OIL
Holanshan
Yangchuan
TAIYUAN
OIL
Shengli
Tzupo
Lanchou
Chiaotso
Pingtingshan
Huaipei
Huainan
NANKING
SHANGHAI
WUHAN
GAS
Nanchung
OIL
GAS
Tzukung
CHUNGKING
Luchow
GAS
Paoting
Kunming
Kuchiu
Maoming
HONG KONG (U.K.)
MACAO (Port.)
C

Nonetheless, China is now self-sufficient in most minerals, has large surpluses in many, and is deficient in only a few. No country can be totally independent of raw materials from abroad, (nor is it necessarily desirable for this to happen), and China is no exception. Table 2 gives a commodity-by-commodity review of PRC's mineral-supply position, which is clearly strong when compared with those of many industrialized countries.

TABLE 2.—MINERAL SUPPLY POSITION OF THE PRC, 1975

Commodity	Share world output, (percent)	Adequacy in production	Reserve potential
Ferrous materials:			
Chromite	(1)	Little produced	Nothing of consequence.
Iron ore	6	High grade ore short	1st rank, low grade.
Iron, pig	7	Adequate	Not applicable.
Iron, scrap	2–3	Can use more	Building up.
Iron, steel ingot	4–5	Imports special products	Not applicable.
Manganese ore	5	Slight surplus	Considerable.
Molybdenum	1	Adequate	Promising.
Nickel	(1)	Greatly deficient	Very poor at present.
Tungsten, mine	20–25	Large surplus	World's largest.
Nonferrous metals:			
Aluminum	1–2	Considerably short	Sizable, off-grade.
Antimony	15–20	Large surplus	Probably world's largest.
Copper	2	Greatly deficient	Moderate.
Gold	(2)	Can use more	Moderate.
Lead	3–4	Growing shortage	So far not plentiful.
Mercury	7–10	Large surplus	1st rank, low grade.
Silver	1	Adequate	Poor, but some stocks.
Tin	10	Large surplus	1st rank.
Zinc	2	Growing shortage	So far not plentiful.
Chemical fertilizer:			
Materials			
Phosphate rock	3	Some imports	Sizable, low grade.
Potassium ore	(1)	Substantially short	Unknown, perhaps moderate.
Pyrite	8	Generally adequate	Moderate.
Salt	15	Slight surplus	1st rank.
Sulphur	1	Becoming short	Moderate.
Nonmetallics:			
Asbestos	4	Surplus, demand growing	Considerable.
Barite	5	Surplus, demand growing	Considerable.
Borates	1	Adequate	Could prove moderate.
Cement	5	Meets demand	Extensive raw materials.
Diamond	1	Adequate	Moderate.
Fluorspar	8	Large surplus	1st rank.
Graphite	10	Adequate	Moderate.
Gypsum	1–2	Adequate	Considerable.
Limestone	5	Meets demand	1st rank.
Magnesite	10	Surplus	1st rank.
Mica	1–2	Adequate	Moderate.
Quartz (piezo electric)	(3)	Adequate	Moderate.
Silica (glass quality)	(3)	Adequate	Moderate.
Talc	3	Slight surplus	Moderate, top grade.
Mineral fuels:			
Anthracite	10	More than adequate	1st rank.
Bituminous coal	15	Adequate	1st rank.
Coke	7	Adequate	Coking coal moderate.
Petroleum, crude	3	Growing surplus	Possible 1st rank.
Petroleum, refined	2–3	Building up quickly	Not applicable.
Natural gas	3–4	Potential surplus	Possibly 1st rank.

[1] Insignificant.
[2] Small.
[3] Unknown.

Note: Percentages represent order of magnitude.

The Chinese have done well in the area of fuel supply. Coal production has been expanded to very high levels by the PRC on the basis of a potential known to be promising. However, little coal surplus has been available for export, and this situation is not expected to change unless projects can be developed for specific markets. The coking-coal supply situation can be improved through further careful industrial appraisal and delineation of resources. The oil industry has been built up from scratch to a position of sizable surpluses for export after satisfying domestic demand. High-level oil production did not come about until the resource potential was drilled and proven to be substantial. China now has much natural gas to consume, and distribution has become the key. Even exports are forthcoming, in view of the liquefied natural gas (LNG) development projects agreed upon with the Japanese. Substantial shale oil resources can back up oil and gas. China is one of the world's two producers of shale oil.

Steelmaking raw materials are extensive enough for supporting a large steel industry, but there are many problems that can only be resolved with sound technical policy. Iron ore suffers particularly from regional shortages and the need to upgrade low-quality ores. Overall supply and demand are in balance, although some high-grade foreign iron ores can be conveniently utilized to facilitate smelting. The supply of scrap iron will be deficient until the industrial economy builds up. Among the ferroalloy materials, there are surpluses in manganese, tungsten, and molybdenum and shortages in chrome and nickel. Important "rare" metals and rare earth industries have been developed recently. Fluxing and refractory materials like magnesite, limestone, and fluorspar are more than adequate. China is currently very short of sophisticated steel products, and imports correspond to about one-fourth of production.

At the moment, China is also deficient in supplies of all the major nonferrous base metals and light metals. Discoveries of porphyry copper and large, high-grade skarn-type copper deposits have been claimed. Generally, copper and aluminum resources are moderate to sizable, but there has not been any substantial effort to develop them on a large scale. The potential for lead-zinc is uncertain. In all cases, much more exploration, drilling, and mine appraisal needs to be done to ascertain the resource potential. Meanwhile, imports of copper and aluminum have been particularly large. Imports of lead and zinc were considerably less than production and surprisingly small in 1974 and 1975.

In nonmetallic minerals, China's cement position is strong both in terms of raw materials and finished products. Much more cement can be produced as needed, and there could be some exports to nearby areas. The fertilizer situation is spotty. China is slightly deficient in nitrogen fertilizers and phosphate rock, but it is increasing production in both. China has adequate pyrite but is rather short of potash. Much salt is produced, but there is little foreign demand for the surplus. The asbestos and barite surpluses are shrinking because of growing domestic demand in industry and oil drilling. The industrial diamond shortage has been resolved through new discoveries and synthetic diamonds. Although domestic consumption is growing, China still has large supplies of fluorspar for exports.

TECHNOLOGY AND ENVIRONMENT

Technologic achievements of the Chinese mineral industries have been uneven. Generally for larger and newer facilities, basic engineering is good, but there is room for increased mechanization. Medium-sized and small facilities tend not to be very efficient, but these serve local needs. The best of the lesser plants are expanded into more conventional operations, and others are eventually shut down. Some older mines and plants have been enlarged somewhat haphazardly because of the uncertainty of development plans. The Chinese operate through design institutes, and workers play an important role in efforts to improve technology. Practical experience is stressed for technicians and students.

China has some of the world's largest well-designed coal mines including a few hydraulic mines, although excavators for open pits are usually on the small side, powered by electricity, and continuous miners and loaders are seldom used underground. However, there is recent interest in large shovels for coal and iron mines. Much work has been done in coal preparation with considerable success. Taching employs the best in Chinese oil extraction technology. Exploration, drilling, and production control are good, but equipment is not the most advanced. PRC is learning about offshore technology and has reasonably good knowledge about pipelines. Chinese petroleum refineries are efficient and standardized, but deficient in petrochemical production. The larger fertilizer and cement plants are well designed, whereas many smaller ones are just not the type used in other countries. The recently installed "Kellogg-type" nitrogenous fertilizer plants are as modern as can be.

Large iron mines are reasonably efficient, whereas small ones are crude. Beneficiation practices have been vastly improved, and high-grade concentrates are now often produced, even from low-grade magnetite and hematite ores. Considering its age, the Anshan steel complex is performing well; however, open hearths are prevalent, and fabrication facilities are somewhat obsolete. The newly built blast furnaces and BOF convertors show significant gains in technical know-how in this complex. Various newer steel plants have better equipment but are not as large as Anshan. There is great interest in oxygen-generating equipment and small basic oxygen furnaces (BOF's). A large BOF has been built in Shanghai recently. Nonferrous mines are generally small and wasteful, often working on low-grade ores. China does not seem to have developed the porphyry copper and skarn copper deposits supposedly found a few years ago. Two of the larger smelters and refineries—Shenyang and Shanghai—are of older design. The Chinese are interested in Japanese copper technology. An imperial smelting process lead-zinc plant presumably has been erected in Shaokuan, Kwangtung. The Chinese know tin, tungsten, and antimony technology fairly well because of the long history of extraction and knowledge of small-scale operations.

The Chinese work hard on reforestation and land reclamation. Most big mines, particularly coal mines, have forest-building programs for mine timber and for improving the environment. In the last decade, coal bureaus were said to have developed a new forest acreage of 2 million mou, or approximately 300,000 acres. The highway management reportedly "made green" 22,000 kilometers, and the railroad management another 5,000 kilometers. Agriculture colonies large enough to sustain the food requirements of major industrial enterprise like the Taching oilfield are being developed from barren or unproductive land. Communes and industrial complexes are continually building new living quarters, and generally efforts are being made to improve health and safety and the environment.

Chinese workers are by tradition diligent, conscientious, hard working, and now disciplined; therefore, they are a great asset to PRC's program of industrial and mineral development. A whole new work force has been trained in the last two decades around the many mines and factories that have been developed. Students and other future technical managers are getting practical experience, and the workers also have an opportunity to learn about technology and management. Another interesting aspect of the Chinese industrial force is that so many women are employed. For example, one out of three workers in the oil fields is a woman. In developing the Szechuan natural gas fields, a women's drilling team has often been cited for excellence in performance.

Also, under the leadership of Hua Kuo-Feng and Teng Hsiao-Ping, there has recently been new stress on science and technology in general and the formal side of technical education. Clearly, a movement is underway to improve the quality of education and sophistication of technology.

GEOLOGY AND RESOURCES

A National Geological Conference was convened during the first half of July 1977, indicating the importance attached to this general subject for China's planners in their overall program of "four modernizations"—agriculture, industry, national defense, and science and technology. The conclusions were that China's geological work had been outstanding, the geological "record" complete, and resources substantial.[6] The number of geologists exceeds 50,000 and drillers and prospectors total several hundred thousand. The masses are utilized in the search for minerals, and many discoveries came about as a result. Chinese drilling is good by world standards, and the overall footage drilled is extensive even compared with figures for industrialized countries. Much has been done in aerial and marine surveys (see below). The Chinese claim that their original work in "geomechanics" and geotectonics has contributed greatly to mineral discoveries. They have also done significant work in instrumentation in the geological field and are most interested to learn more about computerization as an aid to mineral investigations. It was indicated that an atomic absorption spectrographic instrument and a field X-ray instrument capable of very rapid identification of mineral and rock samples had been developed.

As of late 1977, China had completed a 1:1,000,000-scale geological map of China (not yet published),[7] a 1:2,000,000-scale of geological map of Asia (published), and many 1:200,000-scale and 1:50,000-scale regional geological maps within China. Earlier in January 1977, the Chinese Academy of Sciences had presented three geological maps to the International Geological Congress, namely a 1:4,000,000-scale geological map of China, a 1:4,000,000-scale map on the tectonic systems of China, and a 1:5,000,000-scale geological map of Asia. Much hydrogeological work and mapping of water resources have also been done for China. The detailed across-the-board geological work (including structural geology) accomplished on most areas of China has verified that the country has wonderfully complete geological horizons and excellent fossils and indicator rocks by world standards. To support the "four modernizations" program, workers of the Geological Bureau of Geological Survey (at one time a ministry) have pledged that China's mineral potential would be substantially ascertained within 5-to-10 years, with particular emphasis on high-grade iron ore, water resources, fertilizer, raw materials, coal in the south, and geothermal energy. A leadtime on knowledge of resources was believed to be necessary, in order to support rational planning of industralization programs.

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[6] China Reconstructs (Peking). Prospecting Underground Resources. November 1977, pp. 32–35.
[7] Takungpao (Peking). July 3, 1977, p. 3.

The Chinese seem to be optimistic about their mineral resources, although it may still be too early to tell. A leading member of the Chinese Geological Survey has stated that of more than 140 kinds of useful minerals known to the world, reserves of 132 of these occur in China in quantities large enough for exploitation and use.[8] Also, China's reserves of 17 kinds of minerals are very large by world standards, including coal, oil, iron, copper, tungsten, antimony, molybdenum, uranium, salt, magnesite, limestone, fluorspar, and phosphates. Many oil traps have been discovered around the country as a result of reconnaissance surveys over a million square kilometers of sedimentary basins. There has been great success in finding coal in the south. China's "Mesabi" type of iron ranges in the north have been carefully mapped. Very large Skarn-type copper desposits reportedly have been located. Important work has been done on the relationship between tungsten mineralization and tectonics in Kiangsi Province. In the Hochih area of Kwangsi Province (known for tin in the past), three large and two medium "colored metal" (generally means nonferrous) deposits reportedly have been discovered recently. The "Yunnan No. 9 Geological Team" was cited as having achieved great success in geological investigations.[9] Working from Hunan, Szechuan, and back to Yunnan Province, this team was responsible in finding large coal, phosphate, high-grade iron, and copper mines (one each); half of this team was lately sent to Sinkiang to look for high-grade iron ore. An important selenium-bearing cupriferous pyrite deposit was found in Kwangtung Province; also, a very extensive zeolite deposit in the Lishui district of Chekiang Province together with many occurrences in nearby areas. A large "natural soda" deposit has been discovered in Tungpai Hsiaen of Nanyang district, Honan Province.

OFFSHORE SURVEYS

While concentrating on their own technical resources for exploration onshore, the Chinese were looking more into foreign equipment and know-how for offshore operations. Generally, they feel that over 40 percent of China's land area and half that much continental shelf area have potentially oil and gas-bearing sedimentary rocks conducive to oil search. Peking indicates that it had sailed research vessels to near Tiaoyutai and started exploration in the controversial South China Sea. As of yearend 1977, China was operating three foreign-built rigs, had a fourth on order, and finally purchased a fifth.[10] Initially, concrete and earth dikes were built a mile into the Gulf of Pohai. By the late 1960's a number of four-legged fixed platforms were installed. In 1972, a Fuji rig was put to use; and in 1973, China built its catamaran drillship called "Kantan I." Subsequently, Singapore's Robin Loh built and sold two Robray 300 jack-up rigs for the Chinese after fitting them with Houston ETA Engineering's equipment; their Hitachi partners in Japan filled a third order. These roughly $20 million rigs (U.S. equipment on board worth another $10 to $15 million each) in 300 feet of water and 25,000 feet drilling depths. One of these ran into technical trouble while working 50 miles off Pakhoe (Peihai) in the Gulf of Tonkin and foreign experts had to be flown in to fix it. In the summer of 1977, the Norwegian-owned Borrgny-Dolphin which had operated in the North Sea, was bought for $27 to $40 million. This latter semisubmersible rig can work at 600 feet (1,000 feet if modified) and probably will be used near Hainan Island. In November 1977, the Texas-based National Supply Co. sold two self-contained drilling rigs to the Chinese for a total of more than $20 million.

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[8] New China News Agency (Peking). July 10, 1977.

[9] Takungpao (Peking). July 14, 1977, p. 1.

[10] Far Eastern Economic Review (Hong Kong). Awaiting the Rush of Chinese Crude, If Any. October 7, 1977, pp. 67-69.

China's "modern" oceanographic work actually began around 1956, with the adoption of a 12-year research and development plan.[11] However, its historic interest in the sea probably started from the discovery of the compass around 300 B.C. Recently, a large shipyard of the Chin (221–207 B.C.) and Han Dynasties was uncovered at Kwangchow, which embodied a basic construction principle later adopted in modern shipyards. Thus, the country is building up on old traditions. A National Oceanographic Bureau was established in 1964, followed by the inauguration of an observation network. Offshore oil exploration in shallow waters started in the early 1970's and deep sea investigations began in 1976. The principal Oceanographic Research Institute, under the Chinese Academy of Sciences, is located at Tsingtao, Shantung Province, where there are more than 500 people and six research ships working on the physics, chemistry, geology, currents, environment, and sediments of the oceans. A branch institute is located at Kwangchow, with 340 people and three research ships that reportedly have gone to Hainan and as far as the Spratlys. The National Oceanographic Bureau has a "near seas" laboratory working around Choushan Island, a "far seas" laboratory working as far as north of the Fiji Islands, plus an instruments institute and an observation network. There are also marine products laboratories in Tsingtao, Shanghai, and Kwangchow.

The National Geological Bureau, which recently bought aerial survey equipment from the Canadians, completed an aerial magnetic survey (work done during 1974 to February 1977) for seabed minerals in the southern part of the Yellow Sea, the East China Sea, and the South China Sea.[12] The Chinese believe that this work is of fundamental importance. Subsequently, three research vessels and several hundred technicians of the various oceanographic agencies completed an integrated survey of 280,000 square kilometers of the East China Sea, investigating not only general scientific and marine life matters but also, more importantly, the nature of the continental shelf and oil development possibilities.[13]

TRADE AND EXCHANGES

China's overall foreign trade has not shown much change in the last few years. A significant part of the imports in 1973–74 was for industrial equipment and plants; however, subsequent imports were weighed much more heavily in metals, fertilizers, and nonmineral materials. The Chinese have tried hard to export more oil and other products, so as to have foreign exchange to buy equipment and plants for industrialization. There was a trade deficit of about $1.5 billion in 1974 and 1975; however, a somewhat balanced situation existed in 1976. Trade in 1977 at possibly $14.5 billion was up slightly from 1976, and there was a surplus of up to $2 billion in the latter year.

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[11] Takungpao (Peking). Dec. 15, 1977, p. 1.
[12] New China News Agency (Peking). July 5, 1977.
[13] Takungpao (Peking). Jan. 21, 1978, p. 3.

The trade outlook in early 1978 shows that some major changes are in the offing, with expected increases in overall volume and larger sales of fuels along with purchases of "tools" of industrialization. Initially, there will be more emphasis on trade with Japan and Western Europe rather than the United States because of normalization problems. The European Economic Community or the Common Market made a 5-year agreement with China in early February 1978 to expand trade both ways with "favorable treatment" but did not announce specifics. However, total trade was about $2.5 billion in 1976 and possibly $2 billion in 1977, with the foreign exchange balance shifting from $390 million in favor of the Community in 1976 to perhaps $100 million in favor of China in 1977.

According to an unconfirmed report in early January 1978, China apparently ordered about $300 million of mining equipment from Britain for extracting coal and other minerals and a second similar order may follow. The equipment would be used to develop Chinese coal mines to supply an electric powerplant to be built in Hong Kong with up to 3.5 million tons per year of coal starting in the early 1980's. Total United States-China trade has dwindled to about a third of a billion dollars in 1976 and only $375 million in 1977.

Total trade with Japan was about $3.79 billion ($2.26 billion exports by Japan) in 1975, $3.03 billion ($1.67 billion exports by Japan) in 1976, and reportedly $3.47 billion in 1977. A major trading deal was signed with Japan on February 16, 1978, involving $20 billion total both ways during an 8-year period,[14] which would be in addition to normal trade. The move indicates a pragmatic approach by Chinese leadership to building up a modern industrial base, and Japanese interest in gaining a foothold on China's expanding market. Japan will supply $7 to $8 billion in plants and technology and $2 to $3 billion in construction materials during the first 5 years. There could be a dozen large industrial plants covering steel, copper, fertilizers, natural gas, petrochemicals, building materials manufacture, leather, television, plastics, conveyors, et cetera. The Chinese will ship about 47.1 million tons of crude oil and 8.4- to 9.2-million tons of coal, including 5.1- to 5.3-million tons of cooking coal and 3.3- to 3.9-million tons of steam coal, during 1978–82 plus additional tonnages of these fuels in 1983–85. China initially asked for the most favorable possible terms of payment for Japanese products but finally agreed to the principle of deferred payments whereby Japan would loan China some of the money with interest no lower than 7.5 percent.

The Chinese have exchanged technical visits with many countries with growing frequency, particularly in the natural resources and power areas, China's closest relationship is clearly with Japan, with which exchange visits have been arranged in the fields of oil, steel, metals, geophysics, architecture, chemicals, fertilizers, and heavy industry in general. This is why the Japanese now seem to know the Chinese basic industries, particularly oil and steel, better than other nationals. The most important recent visits were instigated by the president of the Nippon Steel Corp. who negotiated the deals involving selling steel products to China and buying oil and coals from China. There were also exchanges involving Chinese steel technicians visiting Japan's very modern facilities, and Japanese visits to advise on expanding China's various steelworks.

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[14] Washington Post. Feb. 17, 1978, pp. A1 and A22.

In mid-March 1976, West Germany announced a close scientific and technical cooperation program with the PRC. In addition to medicine, exchanged visits would be made in coal research, foundries and steel technology, and oil and natural gas. PRC apparently does not intend to use nuclear energy during the next 5 years; however, technical cooperation will be started. In coal, the cooperation could be in actual mining, in further processing, and in automation using data processing. Germany may eventually obtain sizable tonnages of Chinese coal in exchange for the equipment and technical aid furnished.

Canada has had exchange visits with PRC in minerals, petroleum, railroads, and electric power. Australia and the Philippines have stepped up visits, and Thailand and Malaysia have started to send delegations. Technical missions have been dispatched to France, Iran, and Iraq and received from Mexico, Bolivia, and Argentina. A PRC oil team toured Norway in September 1975, and a Norwegian team made a return visit. A Chinese coal mining team visited the United Kingdom in January 1976. A British coal equipment team then went to China, followed by a return visit of a Chinese coal excavation and coal-washing equipment delegation. The Netherlands sent an offshore oil mission to China in March 1976. PRC plans to attend the next International Mining Congress and the Commonwealth Mining and Metallurgical Congress in 1978, and has indicated a willingness to participate more actively in the resource activities of the United Nations Economic Commission for Asia and the Pacific.

Not many Americans have seen much of the natural resources industries in China except the standard visiting areas. However, of late, a few U.S. oil and mining equipment firms have been specifically invited. In July 1977, a U.S. mining equipment delegation was also asked to come to China for 2 weeks under the auspices of the National Council for United States-China Trade. Various Chinese technical groups have toured the United States through the auspices of the U.S. National Academy of Sciences, including a high-level science group, a delegation of oil-exploration experts, a geological drilling equipment team, and a hematite beneficiation study group. In recent years, the National Council had arranged various other Chinese visits to the United States, including an oil-refining team and a minerals and metals trade team in 1975–76. In September 1975, Chinese experts attended the 16th International Conference of Coal Mine Safety Research sponsored by the U.S. Bureau of Mines. In January 1978, a 16-member Chinese delegation of top oil and gas experts visited U.S. facilities at the invitation of the new U.S. Department of Energy.

DEVELOPMENTS IN 1977–78

Of late, many important events have occurred in China's mineral and industrial enterprise. Coal production clearly topped 500 million tons in 1977, and a sharp increase was imminent for 1978. Another National Conference on Coal was convened in late January 1978 to discuss work in the next decade and plans for further mechanization. A western article described China's "grand plan for coal" and the status of coal development there.[15] China started to move toward developing or expanding specific coal mines for new markets, including promoting exports and buying foreign equipment and know-how to increase production. The Kailan (Kailuan) Combine was finally brought to preearthquake output levels. Shansi, the leading coal-producing Province, produced at a record pace. The 1977 output of two relatively new coal combines—Pingtingshan in Honan and Huaipei in Anhwei—was reported at about 11 million tpy each, or roughly twice the production of a third fairly new combine, Feicheng in Shantung. Shensi Province completed the first phase of its largest modern coal mine called Fangshuping. Feicheng has been added to Kailan as combines with hydraulic coal mines.

The Chinese petroleum industry, with capacity already exceeding 100 million mtpy, seems to be taking off in many directions, although nothing much has been said about the Takang field near the earthquake area. Finding more oil at greater depths and around the perimeters of existing fields of Taching and Shengli is most significant. The new Huapei or north China field has sprung into prominence, and samples of this and Shengli's oil were sent to Japan in anticipation of exports in the future. Oil has been discovered in the central-southern part of east China. Petroleum has also been found in the Sanshui (Samsui) basin of Kwangtung Province, along with a large carbon dioxide gas well in another area of the Province. A new oilfield in southwestern Sinkiang apparently has been uncovered. Vice Premier Teng Hsiago-Ping reportedly told Japanese Parliament members recently that Chinese oil reserves have been revised to 400 billion barrels (7.4 barrels equal one metric ton).[16] Exploratory work offshore is gaining momentum. The program to build refineries, petrochemical facilities, pipelines, loading docks, and tankers is similarly moving ahead. Aside from Japan and other markets, China made an arrangement with France in late January 1978 to ship one-half million to 1 million tons of crude oil annually to France.

Within the overall umbrella of the big deal to swap Chinese fuels for Japanese industrial plants and know-how, the role of steel (and related materials) stands out. The Chinese are clearly trying to produce more steel in the years ahead by new large plants, partly with the thought of cutting down on steel imports. To accommodate them and to gain a special position in the rapidly expanding China trade, the Japanese steel companies are helping to build producing facilities in China and providing transport and supporting services and know-how. The prospect of eventually slurrying Chinese coal and oil in Japanese pipe to ships made by both parties is a good example of the future implications of this relationship.

Much basic construction on steel facilities has been done in China recently. The Wuhan Steelworks was substantially completed, after several years of problems. The Anshan Steelworks will be pushed up to 12 million tpy steel capacity through rebuilding and modernization along the lines of the rejuvenated Yawata Steelworks. Apparently, the Peking Steelworks and the Penchi Steelworks will also be streamlined with Japanese help, on roughly half the scale of Anshan. A new

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[15] World Coal (San Francisco), December 1977, pp. 24–26.
[16] New York Times (New York), Sept. 23, 1977, p. A10.

6-million tpy steelworks definitely will be built in the Shanghai area, with two blast furnaces of more than 4,000 cubic meter capacity, three oxygen converters of 250 to 300 tons, continuous casting mills, and various rolling mills. The Chinese have already asked the Japanese for 600,000 tons of steel pilings for building the foundation of the new Shanghai Steelworks.[17] Shansi may be another potential site. In fact, the Japanese report that China plans to build 20 large integrated steelworks [18] before the end of the century. Such an important piece of news clearly needs to be double checked and confirmed. Anyhow, in early February 1978, the Chinese had sent a 21-man delegation to Japan for talks on cooperation. The Japanese will also help China build a large copper-smelter refinery. The Chinese are interested in other kinds of foreign metal plants as well, especially aluminum.

China's 13 large foreign fertilizer plants ordered a few years ago are all scheduled to be in operation in a year or two. Simultaneously, many small- and medium-size fertilizer facilities will also be built. Reportedly, Kellogg has been asked to bid on more coal-fired ammonia plants. Chemicals, petrochemicals, and industrial salts will be stressed. Production of construction materials probably will be more than doubled in capacity in a decade, with equal stress on large and small cement works and additional emphasis on downstream products. Included in new nonmetallic facilities cited for good performance were the Shennan asbestos mine in Shensi, the Tangshan kaolin plant in Hopeh, the No. 4 mica mine in Sinkiang, the Yaan mica processing plant in Szechuan, and the Changchow construction materials plant in Kiangsu. China's biggest pyrite mine (openpit), being built in Yunfu, Kwangtung Province, was near completion. Kiangsi's new underground salt mine and works at Chingkangshan produces enough salt for the Province's 28 million people. The work on saline lakes and playas done by the Tsinghai Salt Lake Institute should be of great importance to the chemical industry. Of esthetic interest is a January 1978 report [19] stating that 11 locations in Ninghsia Province have rich semiprecious stone resources, including agate, jasper, malachite, azurite, amethyst, and bronchantite, which are important for carving, industrial, and jewelry use.

The Chinese interest in nuclear energy appeared to be more intense than a few years ago. A news item states that the Chinese are prepared to talk to French nuclear power equipment representatives who are scheduled to accompany Premier Raymond Barree to Peking in early 1978.[20] It might be recalled that Chinese nuclear power specialists visited Japan in 1972 and Canada in 1973. Very likely, the Chinese are thinking about large scale nuclear power generation by the 1980's.

Basic Situation in 1976

Coal and Power

PRC's coal output showed possibly only a 3 to 4 percent gain over 1975, no doubt held back by the major earthquakes in North China. Kailan's demise (see below) was more than made up by increased output in most other centers and the small coal mines south of the

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[17] Japan Metal Bulletin (Tokyo). February 25, 1978.
[18] Japan Metal Bulletin (Tokyo). January 26, 1978, p. 1.
[19] Takungpao (Peking). January 28, 1978, p. 3.
[20] Asia Wall Street Journal (Hong Kong). Jan. 5, 1978, p. 3.

Yangtze where production reportedly gained 10.7 percent. China's coal output in 1976 was in the 450 to 490 million ton range, corresponding to at least 400 million metric tons of good U.S. coal. Many coal mine conferences were organized during the year. The most important one was a national conference held in mid-November in Peking calling upon "the 3 million coal workers" to work particularly hard during the last 40 days in order to fulfill the 1976 target.[21] At this conference, 10 red flags were awarded to the best coal mining teams. A 1,500-meter coal drill was successfully manufactured. A coal cutter capable of adjusting to different thicknesses (coal seam) presumably was built in Kirin Province.

It has become abundantly clear that the nine provinces in Chiangnan south of the Yangtze River possess considerable coal. During the last decade, Chiangnan's proven reserves and actual production have gained more than twofold, and its self-sufficiency rate reportedly has increased from 50 to 70 percent.[22] Two-thirds of all of the hsiens and cities in "Chiangnan" possess coal resources, and "several tens" of deposits have proven reserves exceeding 100 million tons each, such as the anthracite of Hunan's Hsiangsui, the fat coal of Kiangsu's Wusi, the gas coal of Chekiang's Changkuang, the coking coal of Kiangsi's Fengcheng, the brown coal of Kwangtung's Hainan Island, the anthracite of Hupeh's Huangshih, the coking coal of Anhwei's Huaipei, and the anthracite of Kwangsi's Hoshan, and Fukien's Shaowu, etc. Even in coal-poor Chekiang Province, minable coal reserves have been found in about 27 hsiens. Kwangtung Province's coal output has risen from just over 100,000 tons yearly to approximately 4 million.

Kailan provided the big news for 1976, with the earthquakes striking Tangshan (and Fengnan) in late July. Tangshan one of Kailan combine's seven coal mines was literally mangled, with its shafts twisted and many workers caught underground. The cement plant was quickly put out of commission, but the steelworks was brought back into production fairly quickly. Although Tangshan took most of the punishment, the other six mines were hit hard also. The overall toll apparently reached about 1.5 million people, nearly half dead. However, the country rallied quickly with all the large coal combines sending rescue teams to help, along with supplies and equipment. Some Kailan mines resumed production quickly. In a little over 2 months, six out of seven mines were producing coal again. By mid-December, the Lüchiatun mine was back at nearly 8,000 8,000 tons output per day. Kailan as a whole produced over 20 million metric tons of marketable coal (not raw coal) in 1975, and the guess for 1976 is approximately 15 million tons.

Yearend news on the performance of Chinese coal combines and individual provinces were not as prolific as a year ago. This may reflect lesser gains in output. However, the catastrophe of the Tangshan earthquake and the abundance of significant general events probably also had a bearing on reduced news coverage. The fact that many large coal mines around the country dispatched their best people along with valuable equipment to Kailan no doubt hurt their own output somewhat. This may have contributed to the need for special coal conferences late in 1976 aimed at boosting production. No effort is made here to describe basic data on individual mines and facilities, and interested parties are referred to a new book by the author.[23]

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[21] Takungpao (Peking). Nov. 20, 1976. p. 1.
[22] Takungpao (Peking). Dec. 11, 1976. p. 1.

Shansi coal mines did well, remembering that this province is virtually underlain by coal, produces about a sixth of China's total, and has plans to expand output severalfold. The Tatung bituminous coal combine may have produced 15 million tons of marketable coal in 1976, about twice that produced by the Yangchuan anthracite combine. Anyhow, Tatung reportedly achieved target 37 days ahead of schedule and surpassed the 1976 output rate by about 13 percent; Yangchuan's record was 43 days and 11 percent, respectively.

Shuangyashan is the smallest of three important bituminous coal mines in Heilungkiang, the others being Hokang and Chihsi, each of which produce 10–12 million tons annually. Shuangyashan reportedly attained its 1976 target on November 12, and established a yearly production record in the process; Chihsi fulfilled the year's target on November 25. Shantung was singled out as a province which performed well, fulfilling 1976 target 30 days ahead of schedule with output increasing about 20 percent over 1975. This province is also famous for oil and fertilizers. The two big coal combines in Anhwei Province were reported in the news. Huainan (the older and larger one) and Huaipei together produced up to 20 million tons of marketable coal in 1976. Huainan's old Tatung mine has been rejuvenated, achieving target more than 3 months ahead of schedule, and Huaipei in meeting its 1976 goal by late November established a historic output record. Honan Province's Pingtingshan combine produced more than 10 million tons during the year and Liaoning's Fuhsin coal combine achieved target also.

A new integrated coal center called Holanshan has been established in Ninghsia Province, embracing four coal fields (Shihchuaishan, Shihtanchung, Junchikou, and Hulussutai) in a mining area spread over 50 kilometers. With construction started in 1956, Holanshan now has 8 pairs of big and medium shafts, an openpit coal mine, a large coal washing plant, and industrial systems covering engineering design, shaft construction, and mining machinery manufacture. It provides anthracite and bituminous coal for 350-odd industrial enterprises in about 6 provinces of North and Northwest China. Output in 1975 was 2.4 times that in 1965. The Holanshan center must be producing at least 5 million tons of cleaned coal annually.

Another sizable coal mining center has been reported—Paoting in southwest China.[24] Located in the mountains of southern Szechuan near the Yunnan border and the Chengtu-Kunming railroad, this center covers 100 square kilometers and was first opened in 1965. There are over 100 seams, but rugged terrain, bad wheather, and dangerous working conditions has made development difficult. A thermal powerplant using coal from small mines had to be first built, before proceeding with large-scale mines. Paoting now has seven pairs of modern shafts, and coal cleaning plant, six industrial plants, and many miles of aerial tramways, powerlines, and mine railroads. Two subdivisions are called Taiping and Lungting with Taiping substantially completed by 1969. Paoting now has an annual capacity of possibly 5 million tons of coal, mostly medium-volatile coking coal.

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[23] See Wang, K. P., Mineral Resources and Basic Industries of the People's Republic of China. Op. cit
[24] China Reconstructs (Peking). May 1976, p. 19.

China's electric power is a subject in itself, but a few comments are pertinent because of the special relationship with fossil fuels. PRC's capacity at just over 40 million kilowatts at yearend 1976 was still but one-tenth of the U.S. total. About 80 percent of Chinese electric power is thermal, mostly coal fired and the rest hydro. However, many new facilities based upon oil and gas are being built, and more can be expected. Hydropower is also being pushed, particularly medium and small (over 60,000 of these) hydroplants scattered around south and southwest China. Large thermal and hydro plants are, of course, being built in strategic locations. The largest hydroelectric generator is 300,000 kilowatts, as compared with 200,000 kilowatts for thermal units. The whole area of electric equipment manufacture and capability in power distribution has been moving ahead rapidly, witnessing the fact that high pressure transmission facilities of 50,000 volts were being trial-manufactured in Shenyang.[25] China has been buying large quantities of nonferrous metals abroad for its electric power industry. Abundant supplies of coal, oil and gas, and hydropower in widespread areas give Chinese policy planners important alternatives in developing energy resources. PRC China is already the world's fourth largest producer and consumer of energy, with coal accounting for about three-quarters of the total.

Oil and Gas

PRC China's oil production probably reached about 90 million metric tons (or 1.8 million barrels per day) in 1976, although some feel the figure may be as low as 85 million tons. It was officially announced that the gain over 1975 was 13 percent.[26] By mid-1976, the national output level was moving up to 100 million tons per year. However, growth was subsequently slowed down by adverse factors such as the North China Tangshan earthquake which definitely affected the Takang oilfield, export and distribution difficulties, construction of port and refinery facilities, and the major political happenings. Taching, the premier field, attained a growth rate much lower than the national average, exemplifying behavior of a mature field. On the positive side, startup of a third large oilfield in the Pohai Bay, comparable in magnitude to the Takang oilfield, was announced near yearend, with location given as between Yingkou and Chinchou in Liaoning Province and sometimes referred to as the Panshan oilfield. A Hong Kong oil periodical reports up-to-date developments on China's petroleum.[27]

China ranked about 10th as an oil producer in 1976; however, output corresponded to only 15 to 25 percent the tonnage produced by the world's four leading producing nations. There is no evidence that China can ever break into this select company, yet doubling output in a decade to 200 million metric tons is well within reach. The new Yingkou-Chinchou oilfield adds to the potential, and other onshore fields are being developed. New reservoirs and production zones have been reported for most of China's leading oilfields. The Chinese feel very hopeful about offshore possibilities, particularly in the northern and southern coasts. In recent years, they have dispatched equipment and exploration teams to countries like Norway, West Germany, Venezuela, Singapore, and the United Kingdom where offshore oil and gas production is due to rise sharply. The Chinese apparently are wavering between the policy of rapid and intense development of oil and gas, so as to expand exports for earning more foreign exchange, and the conservative policy of a balanced program of oil, gas, coal, and power. In any case, the Chinese show no indication of accepting production-sharing contracts, not to speak of joint ventures, although they clearly know the importance of foreign technology and equipment.

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[25] Takungpao (Peking). July 3, 1976, p. 1.
[26] New China News Agency (Peking), Jan. 5, 1977, p. 1.
[27] Petroleum News Southeast Asia (Hong Kong). Monthly and annual, 1977–78.

PRC China did not export as much oil in 1976 as might have been expected, perhaps 10 million tons and slightly lower than in 1975. Exports to Japan declined from 8.1 million tons in 1975 to 6.8 million tons in 1976, mainly because of Japanese reluctance to take more of China's waxy crude, and concern over Chinese political sensitivity toward exports. Shipments to North Korea may have risen because of the new pipeline installed, whereas shipments to Romania might be about the same and shipments to Southeast Asia a little lower. Most people assessing Chinese oil exports feel that the tonnage by the early 1980's may be closer to 20 million tons than anything much higher. The program of installing pipelines and building oil-handling ports and coastal tankers made significant headway along with efforts to construct additional refineries and petrochemical facilities. With larger production and little change in exports, it follows that consumption is increasing, and this means more industrial facilities, diesel plants and trains, oil-fired cement plants, vehicles, petrochemicals, fertilizers, and farm mechanization.

Without many private cars, 70 to 80 million tons of petroleum yearly means a great deal to the economy of the PRC. The Taching oilfields near Harbin probably produced about 35 million tons of oil in 1976. The official line is that output in 1976 was 8.7 percent over the 1975 output which in turn was 13.4 percent more than the 1974 output. In evaluating its potential and production, two very important points stand out. One is that Taching has a new field called Ta-king, some distance away from the present center that was opened in late 1973.[28] The second is that the drilling and water injection system of the old field has been recently changed from "line drive" to "9-spot" which means better recovery but lower output. Western newspapers have been reporting that "production of Taching may have peaked." This is probably true in the sense that annual output may not greatly exceed 40 million tons in the future, although it should be remembered that the Sungliao Basin where Taching is located is a sizable area. However, Taching very likely will last for decades, although it shows signs of maturing. Taching's oil is sent everywhere, and of late, by pipeline to North Korea also. The refinery at Taching is only 5 to 6 million tons. A large fertilizer plant rated at about a million tons of fertilizers and 300,000 tons of synthetic ammonia yearly was recently completed.[29]

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[28] See Wang, K. P., "Mineral Resources and Basic Industries of the People's Republic of China," op. cit., pp. 97–98.

[29] Takungpao (Peking), Dec. 28, 1976, p. 1.

The Shengli oilfield near the mouth of the Yellow River and with oil reserves "on a par" with Taching produced more than 15 million tons—maybe 17–18 million tons—of crude oil in 1976. Output in 1975 was said to be 34 percent more than in 1974. However, the official statement for 1976 only mentions that state quotas for crude oil and all other major products were overfulfilled, and "new discoveries have been made in prospecting." [30] Two fertilizer plants, a catalyst plant, and a synthetic rubber plant are in being and there is a scheme to change the course of the Yellow River. Shengli has a 2.5-million-ton refinery and a 3.5-million-ton refinery, which are connected by pipelines across the Shantung Peninsula to the new Huangtao port near Tsingtao.

The Takang oilfield near the Pohai Bay 60 kilometers southeast of Tientsin has not yet been totally built up, although annual output may have already reached 12 million tons. Takang's crude output gained 60 percent in 1973, nearly 25 percent in 1974, and 16 percent in 1975. Its actual 1976 production was reported as close to the state quota. A new oil-gas field was found in mid-1976. The Tangshan earthquake hit Takang mildly as well. Chinese reports say that extraction never stopped, production declined in the first 2 days, and operations returned to normal on the third day. Only a relatively small refinery was in existence in early 1975, but a petrochemical complex of the scale of Chinshan near Shanghai was under construction in 1976. The hope is to also produce liquefied natural gas for export to Japan. Oil and gas are piped to Tientsin where a large refinery and petrochemical complex were being expanded. Additionally, a pipeline has been built from Tientsin to Hsinkang, probably with a view toward exports.

The new oilfield can be designated Yingkou-Chinchou or Panshan, which lies between these two cities in Liaoning Province. It is slightly inland from the Pohai Bay, covering 62 kilometers in length and possibly extending to the bay. Development began in 1974 and the first well "heavy in sulfur smell" was spud on June 25, 1976. Yinkou-Chinchou has been proclaimed as northern China's "fourth big oil field," the others being Taching, Shengli, and Takang. As far back as 10 to 12 years ago, it was felt that promising oil resources might be found in this area.

The Karamai oilfield located in western Dzungarian basin in Sinkiang Province, 147 kilometers by pipeline to the Tushantzn refinery, has expanded production twofold in a decade. In 1975 alone, output was raised 65 percent over 1974. All major production goals for 1976 were said to have been met and these were higher than the 1975 levels. Karamai's old oilfields have been streamlined and a new field built, equipped with measuring and transfer stations, necessary derricks, and 50 kilometers of new pipelines. Annual crude output may have risen to the 6–7-million-ton range.

China's natural gas has become a very significant resource on a par with oil, and production should rise sharply in the years ahead. Output of natural gas reportedly increased by 11 percent over 1975. Firm figures are not available, but production of 100 billion cubic meters annually should be achieved before 1980. Natural gas is associated with various oilfields, particularly Takang and Taching. Szechuan Province has long been famous for natural gas itself, and supply has quadrupled in the last decade. Gas is used at two-thirds of Szechuan's steel plants, over 80 percent of the salt facilities, more than 70 percent of the fertilizer plants, and in many cement plants as well. The Chinese are hoping to sell liquefied natural gas (LNG) from Takang to Japan.

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[30] New China News Agency (Peking), Jan. 2, 1977. P. 1.

China has two of the three shale oil-producing operations in the world, the other being the Estonian facilities in the U.S.S.R. The older operations at Fushun, Liaoning Province has been deemphasized, because of the natural crude oil discoveries. However, the newer operations at Maoming, Kwangtung Province, have been often mentioned in the press. The fact is that Maoming has six shale oil retorting plants,[31] together producing at least 1.5 million tons of shale oil annually. It has a regular crude oil refinery as well; and a 140-kilometer 1-meter, pipeline from Chanchiang was completed to Maoming near yearend 1976 to process crude oil brought in from elsewhere.

The steady increase of oil and gas production in China has necessitated the building of pipelines and ports. Szechuan Provience has a network of natural gas pipelines and an important gas line was recently built in Yunnan Province. The first long and large oil pipeline was completed near the beginning of 1974—1,152 kilometers between the Taching oilfield and the port of Chinhuangtao; this was subsequently extended to Peking. Another line was later built from Taching to Tiehling and Talien (Dairin) with a branch line to North Korea. Lesser lines have been constructed from the Takang and Shengli oilfields to nearby markets and ports. Talien has a new oil port, capable of accommodating up to 100,000-ton vessels. All other ports can only handle up to 50,000-ton ships. A concerted program is underway to build up shipping ports and unloading facilities.

Oil refining and petrochemical capacities are being rapidly expanded to accommodate the new oil and gas coming on stream. Many refineries are being enlarged or newly built bringing up the People Republic of China's total capacity to at least 70 million tons by early 1977. Three prominent refining and petrochemical complexes currently being built are Whampoa near Canton, Takang, and Chinshan near Shanghai. All three must be of the magnitude of 5-million-tons-per-year. Other large refineries are located at Fushun, Taching, Lanchow, Shanghai (old one), Peking, Shengli, Talien (or Dairen), Chinhsi, Nanking, Anshan, Maoming, Yumen, Tientsin, and Karamai-Tushantzu. Capacity of the Nanking refinery reportedly was doubled—originally 3 million tons yearly. At the Peking refinery, five new petrochemical units were placed in operation during 1976. The 1.5–2.0-million-ton Tushantzu refinery in Sinkiang was being substantially expanded, and the Maoming refinery was being enlarged also.

Iron and Steel

For the People's Republic of China iron and steel industry 1976 was a bad year. Plant capacity was partly idle, and basic construction lagged. Overall Chinese steel output declined to below the 25-million-ton range, with the large plant sector doing better than the small plant sector. The Anshan and Peking steelworks did reasonably well. However, the Wuhan steelworks was behind schedule in installing its foreign equipment. Tin was being saved for a new tinplate mill to be completed at Wuhan. Medium and small steel plants which produce one-fourth to one-third of the country's steel, encountered setbacks in North China because of the earthquake.

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[31] China Reconstructs (Peking), August 1976. Pp. 18–19.

Problems in steel production and metal shortages in general have caused difficulties for all heavy industry. Inadequate supplies meant lower inputs for vehicles, mechanical equipment, farm machinery, and other important products. Demand for steel is becoming increasingly acute, because of the agricultural mechanization program and the sharply expanding use of petroleum which must be distributed to the markets. Southern China may be slightly better off, since many small plants and industries recently established south of the Yangtze in recent years.

PRC has been importing 4 to 5 million tons of iron and steel products annually to complement domestic output. The country is extremely short of finished steel, particularly seamless steel pipes. Japan has been China's leading steel supplier by far, sending 2.85 million tons of products to China in 1974 and 2.81 million tons in 1975. The contracted tonnage from Japan was 650,000 tons in the first half and 1,590,000 tons for the second half of 1976. The Chinese were not as anxious to buy steel as the Japanese were to sell, partly because of the difficulty of paying for it by selling oil. However, this situation is expected to be temporary, since Japan is the most logical supplier of steel to China and buyer of petroleum from China.

In a special magazine section of Takungpao dated November 1976, an article entitled "New Developments in Iron and Steel Smelting Technology" showed a pictorial model of a steel plant with three-unit 120-ton basic oxygen furnaces (BOF's) capable of turning out 2.5 million tons of steel annually. This clearly illustrates what the Chinese steel planners are thinking about. The PRC-designed 120-ton BOF is being pushed, and sizable BOF furnaces reportedly have already been installed at the Anshan, Penchi (Penhsi), Shanghai, and Paotou steelworks. The whole smelting process was described in this article, pointing out the great advantages of BOF's over openhearth operations: Lower unit investments, shorter construction time, higher production, and better quality control. It was further said that Chinese technologists were working on (1) recovery of fuels from smoke and dust; (2) reuse of iron-oxide dust as iron raw material; (3) use of slag for cement manufacture; and (4) better utilization of waste heat. PRC may already have a 150-tonner, BOF and is studying even larger furnaces.

Anshan continues to overshadow all other Chinese steel plants. It has 11 blast furnaces (the last is a 2,000-cubic-meter one), 25 open hearths (200 to 500 tonners), two large BOF's, various mines and sintering and beneficiation plants, plus blooming, plate, hot strip, rail, and pipe mills. However, a 12th blast furnace of 2,580 cubic meters was nearing completion. Anshan's steel capacity may be about 7 million tons, and output in 1976 probably was below this level. Anshan's mines now produce concentrates of better than 60 percent Fe grade, and the sintering plant recently installed is sizable. One production unit with a 4-cubic-meter shovel (at the Kungchangling mine), produced at the daily level of 10,000 tons of mine-run ore during late 1976. Anshan iron ore is much like Mesabi ore in the United States, but Anshan does not have pelletizing plants yet. In 1976, the Japanese sold a Kowa Seiko "sulfide" iron ore pelletizing plant to PRC however, this probably is not for Anshan since the ore there is better known for silicates rather than "sulfides."

Wuhan's three byproduct coke plants, large sintering plant, four 1,400 to 2,000-cubic meter blast furnaces, eight mostly 500-ton openhearth furnaces, hot rolling mill, plate mill, and rail mill have been producing steel ingot at the annual rate of more than 2.5 million tons. It has at least four iron mines, including the Tayeh openpit and the Chengchao and Tahungshan underground mines. Meanwhile, $550 million worth of West German and Japanese fabrication equipment are being installed: a new 3-million-ton hot strip mill, (including a 70,000-ton silicon Sendzimer steel mill, and a tinning line), a 1-million-ton cold strip mill, and a continuous casting mill. Some say that installation of these foreign mills will be delayed as much as 18 months after late 1977—the original date, yet it has been reported that Chinese have been saving tin for the tin plate line. Since the new fabrication equipment seems to be superimposed on already adequate facilities, it would not be surprising if Wuhan may soon be building additional blast furnaces or large BOF's. Wuhan's October 1976 steel output was said to be 39 percent higher than the September 1976 output,[32] implying severe operational difficulties earlier.

The Peking, "Capital," or Shihchingshan steelworks has been stabilized at about 1.5 million tons of steel ingot and 2 million tons of pig iron annually. Actual production in 1975 was said to be somewhat lower. Peking has two 400 to 500-cubic meter plant furnaces and two 1,000 to 1,200-cubic meter ones. It also has three 30-ton BOF's, several fair sized open hearths, coke plant, sintering plant, blooming mill, billet mill, and bar mill. The Chiennan and Lungyen mines supply Shihchingshan with better than 60 percent Fe grade concentrates. This steelworks is very diversified, having about a hundred operational units, including facilities for making ferroalloys, refractories, cast iron pipes, and nonferrous metals.[33]

Shanghai has perhaps eight steel plants; only half of these are ingot producers. The No. 1 steelworks appears to be the largest, followed by the No. 3 steelworks. Shanghai as a whole has a steel capacity of at least 3 million tons and possibly as much as 5 million tons. The No. 1 steelworks has three 30 to 35-ton BOF's, a 120-ton BOF, and two 70-ton openhearths. The medium-sized Maanshan Steelworks in nearby Anhwei, reportedly has raised output steadily during 1976. The Paotou Steelworks started to produce sizable tonnages of pipes for use in oil distribution. A new 150,000-ton steel making unit of the medium-sized Lanchow Steelworks was brought into production in the fall of 1976.

"Colored Metals"

ALUMINUM

Expansion of power generation and transmission facilities in China has greatly increased demand for aluminum and copper. The country is definitely in a "take-off" stage in aluminum consumption, particularly in view of the overall industrial activity that will be created by the anticipated rapid growth in oil and gas production and consumption. PRC has been increasingly short of aluminum during the last decade, with hardly any large facilities built internally in the face of obvious shortages. Lack of adequate cheap power, high-grade resources, easily available capital, and latest know-how, plus difficulty in establishing big integrated projects, are factors holding back development. Nevertheless, China probably produced about 200,000 tons of aluminum annually in 1975 and 1976.

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[32] Jen-Min Jih-Pao (Peking). Nov. 4, 1976. p. 1.

[33] The Peking Steelworks is Making Rapid Progress. Ti-Li Chih-Shih or Geographical Knowledge (Peking). January 1977, pp. 1–4.

The policy has been to buy aluminum abroad to supplement requirements. Annual aluminum imports are already more than 150,000 tons and could reach 300,000 tons. Importation in the next few years will be affected by the foreign exchange that can be earned by oil exports. However, PRC definitely would be thinking about building some new large plants at home where adequate power supplies might be developed, such as at some hydropower sites and natural gasfields. Yet, it may be advantageous to continue to import a certain proportion of supply because of better bauxite resources and already existing and very efficient facilities worldwide.

The 100,000 tpy Fushun reduction plant has horizontal stud Soderberg cells rated at 450 kilograms per day per cell. There are two workshops, each with two potlines of 160 pots per line. The plant seems to be fairly efficient and uses acid-spar from T'ao-lin. The Nanting alumina plant in Changtien, Shantung, with four big rotary kilns and corresponding chemical facilities, has been steadily expanded in recent years. A new small alumina plant was recently completed at Wenchang County, Hainan Island. An aluminum plant with at least 100 cells has been mentioned for Sanmen Gorge, the site of a scaled down hydroelectric irrigation project in the Honan-Shansi border on the Yellow River. This implies a plant of 20,000- to 30,000-ton size. The Japanese say there is a plant of this scale at Lanchow, Kansu. Other small plants might have been erected at Taiyuan (Shansi), Wuhan (Hupeh), Changling (Kirin), Tsingtao (Shantung), Nanning (Kwangsi), Hofei (Anhwei), Sian (Shensi), Kweiyang (Kweichow), Chiaotso (Honan), and Changsha (Hunan). In Yiliang County of Yunnan Province, about 80 kilometers southeast of Kunming, there is reportedly built a very new aluminum plant with two production lines.

The PRC imported about 100,000 tons in 1972, 110,000 tons in 1973, and 75,000 tons in 1974. Under low price conditions, the Chinese contracted to buy over 450,000 metric tons of aluminum from abroad during 1975 but only 50,000 tons at the most in 1976 when prices went up. Alusuisse of Switzerland, Pechiney of France, Kaiser Aluminum and Honmet of U.S.A., Masal of Norway, and Alcan of Canada all concluded large contracts with China during 1975, along with half dozen other "international firms" for lesser tonnages. Some actual shipments to China in 1975 were: 62,510 metric tons from the United States, about 24,400 tons from the United Kingdom, 33,000 tons from Canada, 38,430 tons from Japan, 48,120 tons from France, and 50,160 tons from Norway. United States exports of unwrought aluminum in 1976 were 37,350 metric tons. Trade circles believe that the PRC may buy up to 160,000 tons of aluminum in 1977. PRC seems to be shopping around for good deals, vascillating between traditional suppliers and new suppliers.

COPPER, LEAD, AND ZINC

Chinese demand for these nonferrous base metals has increased greatly, as a result of the accelerated industrial and agricultural growth in recent years, spurred by the rapidly expanding use of power and petroleum. In 1976, copper production was about 150,000 tons, and lead and zinc production, 100,000 tons each. The country is at least short of 100,000 tons of copper annually, as well as 100,000 tons of combined lead and zinc. During 1973–74, PRC's imports of copper totaled more than 300,000 tons and during 1975–76, probably less than 200,000 tons.

There is hardly any news about China's relatively small nonferrous mines and smelters. The better known copper mines include Hungtoushan near Fushun, Huatung at Chingyuan, Tunghua in Kirin, and Tungkuanshan in Anhwei. A new copper-zinc mine has been mentioned for Tehsing, Kiangsi Province. China's porphyry deposits apparently have not yet been developed. The principal nonferrous smelters, which refine considerable secondary copper and lead, are Shenyang in Liaoning and Shanghai. Shuikoushan and Taoling are among the leading lead-zinc mines. However, Kwangtung Province may have become an important lead-zinc producer, since it has long been rumored that there is a smelter at Shaokuan. It is curious to note that PRC has been exporting small quantities of zinc, despite a traditional shortage.

In late 1975, the Chinese were negotiating with Japanese firms with regard to acquiring nonferrous technology—with Mitsubishi Metal concerning electrolytic copper process employed at the Onahama smelter, and with Furukawa Mining and Sumitomo Metal Mining concerning large scale copper smelting. These talks may not lead to anything concrete, but the interest is obvious.

China handed over the 1,100-mile, $250 million Tanzam Railway to the Presidents of Tanzania and Zambia on July 15, 1976, with the Presidents of Zaire and Botswana attending the ceremonies as well. This could very well mean that PRC will be getting more copper from Africa in the future. A long-term contract with Zambia calls for 50,000 tons of copper annually, and large quantities might eventually be purchased from Zaire also. Chile might have sold China over 30,000 tons of copper in 1976, remembering that actual exports of copper by Chile to China was 55,500 metric tons in 1973 and 40,800 tons in 1974. The Chileans were talking about renegotiating a large Chinese loan contract to be repayed by Chilean copper, nitrates, and iodine. An understanding with Peru is still in effect for approximately 40,000 tons of copper annually, plus 10,000 tons each of lead and zinc in exchange for help in developing the Tintaya copper deposit in Peru.

There is no known follow-up on copper concentrates from Bougainville, after an initial trial shipment of 10,000 tons of concentrates to PRC in late 1975. However, Philex Mining and Atlas Consolidated of the Philippines balked in late 1976 about supplying China with the 5,000 tons remaining on the 20,000-ton import order for copper concentrates, because of the considerable rise in copper price since the initial agreement.

EXPORT METALS

China is one of the "big three" world producers of antimony, along with South Africa and Bolivia. However, the 10,000 to 13,000 tons produced annually by China (and half that much exported) do not add up to too much money, because of the limited tonnage and moderate prices. The Chinese have not tried to push the sale of antimony, although there is more metal available than concentrates. Hsikwangshan in Hunan Province has long been the main antimony producing district in China. A "summit" meeting of antimony producers was held in Bolivia during 1975. This was followed by a visit to PRC by a Bolivian antimony delegation in 1976.

The Chinese tin industry probably has not undergone much change, but assessments of its recent performance have varied. Reserves are still acknowledged as large, and Kuchiu of Yunnan and Fuhochung of Kwangsi are still considered as the principal producing districts. However, some feel that national production may have dipped below 20,000 metric tons annually. It is a fact that overall exports have dropped from about 15,000 tons in 1975 $6,300 tons to the United States) to 7,000–8,000 tons in 1976, and may even be much lower in 1977, according to trade circles. A Malaysian mission to China was assured that PRC had no intention of disturbing world markets. Chinese tin consumption may have risen to 8,000 to 9,000 tons annually and a new 100,000 tpy tinning line soon to be completed at the Wuhen steelworks should boost tin use further. Thus, unless production is stepped up, China may have less tin to sell in the future even though prices have skyrocketed to nearly $5 per pound.

China's extensive tungsten resources, mainly located in the Tayu District of Kiangsi Province and secondarily in Kwangtung and Hunan Provinces, are probably being mined at an annual rate of 15,000 to 20,000 tons of concentrates per year. Domestic consumption has steadily risen, because of the expanded use of drill bits and machine tools. There may be need for stockpiles to be built up. Exports of concentrates, which have been hovering in the 10,000- to 12,000-ton range, declined to possibly the 8,000- to 9,000-ton level in 1976 despite very high tungsten prices. It seems that the Chinese must invest and explore more in order to avert a decline in tungsten output. An entire line of tungsten products are produced by the Chinese, including synthetic scheelite, paratungstate, powder, wire, and tungsten carbide. Although regularly attending the Geneva meetings of the United Nations UNCTAD and the Primary Tungsten Association, the PRC continues to keep silent on its tungsten situation. However, they did imply that exports in 1977 may be down by as much as 50 percent.

"RARE METALS"

Chinese deposits of rare earths are large by world standards and widely distributed. In less than 20 years, China has also emerged as a very important producer and consumer of these exotic metals. "Reports from the current Canton Fair say China is offering exports of rare earth metals and ferroalloy metals such as beryllium, tungsten, molybdenum, barium, niobium, zirconium, and titanium for the first time. American, Japanese, and British buyers are said to be showing keen interest, but no firm orders have been disclosed so far."[34]

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[34] Metals Week (New York), May 10, 1976, p. 1.

Kwangtung Province's "rare" metals economy was recently described.[35] Most of the development occurred after the Cultural Revolution. Beneficiation and extraction technology related to 40-odd types of "rare" metals reportedly have been mastered. During the fourth 5-year plan (1971–75), output value increased threefold each year, to meet the needs of metallurgical, nuclear energy, chemical, electric, electronic, semiconductor, and "special area" industries. "Raw materials have been found from land to seashore and from the plains to the hills." Developments at the Pantan tin mine are worth mentioning. Discovered in 1958 for tin, this mine reportedly recovers about 11 types of byproducts which together constitute two-thirds of the mine's output value. Germanium used for defense purposes is a new byproduct recovered, and technology has progressed to a state that germanium recovery has reached 75 percent. Kwangtung Province is more than self-sufficient in "rare" metals.

"China has developed by its efforts a fairly comprehensive and expanding, high-quality metals industry, basic to electronics, semiconductors, and special instruments and detectors. Surpluses of many metals are available for export. Tellurium, arsenic, cadmium, and gallium are produced at 99.9999 percent quality. Many more are produced in 99.999 percent quality, including copper, lead, zinc, tin, bismuth, cadmium, antimony, gallium, nickel, phosphorus, sulphur, boron, arsenic, and tellurium. Lithium for atomic energy and advanced-technology use is produced at 99.99 percent grade."[36]

Industrial Minerals

ASBESTOS

Chinese production of asbestos remained at the approximate annual level of 150,000 tons. Shihmien in Szechuan, with about a dozen fairly up-to-date projects, continued to be the country's leading producer by far. A second major asbestos deposit is located at Penhsien, also in Szechuan. Shihmien's asbestos is of the long-fiber chrysotile variety.

BARITE

Chinese output of barite probably topped 300,000 metric tons in 1976, 7 percent of the world total. The steady gain in production is a reflection of the growing domestic market in oil and gas drilling. China seems to have extensive barite resources, and a surplus available for export. Chinese barite has been offered in world markets in three grades—90 percent, 95 percent, and 97 percent.

CEMENT

China's cement industry continued to expand, with production probably exceeding the 35 million-ton level in 1976. The country has at least 30 large cement plants capable of producing more than 200,000 metric tons per year, with four rated at more than a million tons. One of these large plants, a 700,000-tonner at Tangshan, was said to have been a casualty of the severe earthquake in late July. The French were helping to build a large cement plant, location unknown. There are more than 30 other plants with capacity in excess of 100,000 annually. China has more than 3,000 small cement plants—one common category is the 3,000–7,000 tonners, and a second, 10,000–50,000 tonners. These plants account for more than half of the national output of cement. The Chinese claim that the small plant sector fulfilled the 1976 target 33 days ahead of schedule and produced about 7 percent more than in 1975. Apparently, Shantung led the provinces in "small cement plant" production, with output in 1975 reported at 2.44 million tons [37] and output in 1976 at least 20 percent higher. Kwangtung Province with 190 small cement plants produced 12 percent more in 1976 than in 1975, and these small plants accounted for 70 percent of the province's cement output.

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[35] Takungpao (Peking). Aug. 17, 1976. p. 3.

[36] Mining Annual Review 1976. London Mining Journal, p. 389.

DIAMONDS

China's needs for industrial diamonds has steadily increased, particularly for drilling purposes. Up until 1971, most of the diamonds were imported. It was around this time when the Changte diamond mine in western Hunan was brought into production. In late 1973, synthetic diamond manufacture began, and now there may be a dozen synthetic diamond plants operating in China. It was said that synthetic diamond drill bits were used to drill China's deepest oil and gas drill hole—7,058 meters depth somewhere in Szechuan Province. However, Western commercial circles believe that Chinese synthetic diamonds are not of too good quality. In mid-1976, a large diamond deposit was found somewhere in Liaoning Province.[38]

FLUORSPAR

A prominent world producer and exporter of fluorspar, China's output in 1976 probably topped 350,000 metric tons. A large surplus has been traditionally exported, particularly to Japan and the Soviet Union. However, Japan's overall steelmaking and aluminum requirements on a unit output basis has been declining. On the other hand, PRC's domestic consumption is increasing. The United States reported receipt of a trial shipment of Chinese "high-grade lump" fluorspar in the customs return for July 1976, of about 6,300 tons. Most Chinese fluorspar is metallurgical grade, but a significant share is acid grade from the Taoling mine in Hunan Province.

SALT

There were no overall national claims for salt production by PRC for 1976, probably because of the earthquakes and other difficulties during the year. Several large salt fields are around the Pohai Bay, near the earthquake areas. However, there is no particular reason why these saltfields should be greatly affected. Apparently, the southern saltfields did well; comparing 1976 with 1975, Kwuantung's output was said to have increased by 40 percent and Hainan's output rose by 25 percent. Record production was also reported for Szechuan, Sinkiang, and Ninghsia Provinces. It is estimated that Chinese salt production in 1976 was at least 30 million tons.

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[37] New China News Agency (Peking). Nov. 16, 1976.
[38] Takungpao (Peking). July 25, 1976, p.1.

SODA AND BORATES

A comprehensive survey carried out by Chinese scientific workers on the Tsinghai-Tibet Plateau established the fact that Tibet has about 1,000 lakes covering nearly 30,000 square kilometers or a third of the country's total in lake area. Most lakes are brackish, many are deep, and a good number are dry. The lakes reportedly contain rich mineral and aquatic resources. Abundant deposits of salt, soda, sodium sulphate, and borax are found in many of the lakes in northern Tibet.[39] The survey team under the Chinese Academy of Sciences further verified that one small salt lake contains 5 million tons of salt and 50 million tons of sodium sulphate.

Fertilizers

NITROGENOUS FERTILIZERS

PRC China probably produced somewhere between 3 and 4 million metric tons of contained nitrogen (N) in 1976, already significant by world standards. Considering the growth of the oil and gas industry, the Program to build much more small nitrogenous plants, and the 13 new large foreign plants (including eight Kellogg plants located in the Provinces of Heilungkiang, Liaoning, Hopeh, Yunnan, Kweichow, Hupeh, Hunan, and Szechuan) in various stages of construction, the country's fertilizer production should reach 7 to 8 million tons of nitrogen by 1980.

China is still greatly dependent upon imports of nitrogenous fertilizers, mainly from Japan. It happens that Sino-Japanese trade in fertilizers has been very important in world transactions. In 1975, Japan exported 1,169,000 metric tons urea—(46 percent N), 307,000 tons of ammonium sulfate—(21 percent N) and 499,000 tons of ammonium chloride (25 percent+N) to China, down considerably from the peak year of 1973. The agreement for the first half year of 1977 was for Japan to ship 500,000 tons of urea and 200,000 tons of ammonium sulfate to China. The Chinese also negotiated additional contracts to purchase over 300,000 tons of urea from east European countries in 1976, plus significant amounts of ammonium sulfate from west European countries.

In addition to about a dozen large nitrogenous fertilizer plants that have been in operation for some time, plus a similar number of large plants now being built, China has more than 1,200 small- and medium-sized nitrogenous plants scattered around the country. In 1975, small plants provided 58 percent of China's total synthetic ammonia output. Production from small plants further increased sharply in 1976. A typical small plant is one which produces 3,000 to 5,000 tpy of aqueous ammonia or ammonium bicarbonate. Medium-sized plants may produce 50,000 to 100,000 tpy.

Shantung has become the leading nitrogenous fertilizer producing province in China. In 1976, there were about 120 small nitrogenous plants plus one large plant. In early 1977, the Shengli general petrochemical complex associated with the oilfield of the same name was placed in full-scale operation, and it has two chemical fertilizer plants, in addition to oil refineries and plants producing synthetic rubber and petrochemicals. The Taching oilfield also recently completed a large chemical fertilizer plant based upon natural gas, capable of producing a million tons of various fertilizers annually.[40] Szechuan Province has nearly 100 small nitrogenous plants plus a number of large plants, all based upon natural gas. Kwangtung Province also has a growing number of fertilizer plants, particularly small ones.

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[39] New China News Agency (Peking). Apr. 28, 1977.

PHOSPHATES

China's phosphate rock resources are widespread throughout the eastern and southern areas of the country. Most of the deposits are sedimentary rather than igneous in origin. Reserves are large, but the quality is uneven and often low grade. The best known deposits are located in the provinces of Yunnan, Kweichow, Hunan, and Hupeh. In Yunnan there are open pit and underground mines in the Kunming and Kunyang areas and probably apatite deposits near the Vietnam border. The Kaiyang region of Kweichow, with more than one large mine, has been worked for a decade. Liuyang, Shihmen, and Huachiao are known locations of phosphate mining in Hunan where output has risen tenfold since 1965. The Chinghsiang mine in Hupeh had an annual capacity of 600,000 tpy of phosphate rock. A 20-million-ton phosphate deposit may have been discovered in the Chaoy anglin area of Kiangsi Province.

Phosphates are found in many localities in Foshan, Kwangtung Province. A large deposit of high grade ore was recently reported for the Hsuai-yi-ling area on the shores of Tatu River in Szechnan Province. A large phosphate rock deposit has been found at Fanshan, Chulu Hsien, Hopeh Province.[41] This deposit is said to be the largest of its kind found in North China, and will mean that phosphate rock from faraway Hunan and Kweichow Provinces will no longer have to be shipped in. Actually Shantung has many small phosphate operations also.

PRC China's phosphate rock production may have risen to about 4 million tpy. A few years ago imports may have reached 2 million tpy, mainly from Morocco and the Lao Cay apatite deposit in northern Vietnam. When Morocco tripled its price, Chinese imports dwindled to small tonnages. Morocco has since cut its prices, perhaps making it again attractive to import high grade ore.

The bulk of the phosphate rock supply is converted to chemical phosphates, although some is directly applied in the ground form. China has about 1,500 small phosphates plants (430 in Shantung Province) which together produce three-quarters of the country's chemical phosphate production totaling possibly 10 million tpy. Relatively large superphosphate plants that have been mentioned in the press include Nanking, Changsha in Hunan, Hunghochou in Yunnan, Shanghai, Taiyuan in Shansi, Canton and Chanchiang in Kwangtung, and Tunghsiang in Kiangsi.

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[40] Takungpao (Peking). Dec. 29, 1976.
[41] New China News Agency. Jan. 21, 1977.

CHINA'S ELECTRIC POWER INDUSTRY

By William Clarke

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SUMMARY AND CONCLUSIONS

There exists a widespread shortage of electric power in the People's Republic of China (PRC) today that is adversely affecting the economy and which must be corrected quickly if the program to modernize industry, agriculture, science, and technology, and national defense is to be successfully implemented. Electric power is a "vanguard" industry which in a developing country like China must advance at a pace 1.3 or 1.4 times that of industry generally.

The shortrun solution to the power shortage is being sought in the fall 1977 directives of Chairman Hua calling for conservation, fuller utilization of existing generating capacity, and its more efficient operation. In the longer run, China will place reliance on the continued development of both hydroelectric and thermal power stations. No nuclear stations are currently operative, but the Chinese will probably soon begin one. Although both large and small power stations will continue to be built, the greater emphasis will be placed on development of China's hydroelectric potential, the largest in the world. Currently, the PRC is the fourth largest producer of primary energy in the world after the United States, the Soviet Union, and Saudi Arabia.

In 1977, the PRC's electric power industry generated about 136 billion kilowatt-hours of power or 6 to 7 percent that of the United States. This was enough to place China ninth in power output. Installed capacity on December 31, 1977, was estimated to be 40,500 megawatts. The bulk of this capacity is found in the 192 known thermal and hydro stations of 30 megawatts capacity and over. Of these, 126 units are thermal stations and 66 are hydroelectric, some are currently under construction or are being expanded. Additional stations of this capacity or greater are thought to exist. About 62 percent of the capacity is thermal, the balance hydroelectric.

To adequately support a 10-percent rate of industrial growth, the power industry would need to add about 5,300 megawatts to capacity this year, a 13-percent rate of growth, and about 12,700 megawatts in 1985 to provide capacities of 45,800 and 108,000 megawatts, respectively. The domestic power equipment manufacturing industry, while quite substantial, does not appear capable of meeting this requirement. Thus, if a 10-percent industrial growth is to be achieved, Peking will have to import power plants and equipment from abroad possibly expending as much as $300 million annually during the period 1978–85.

It does not appear that between now and 1980 the electric power industry can accelerate growth to the level to support a 10-percent industrial rate of growth, 1978–80. It does seem possible, however, that by 1981 acceleration of developments in the industry could support such industrial growth. To achieve this the Chinese will need to:

(*a*) Invest heavily in the development of the coal industry;

(*b*) Improve rail transport and develop "mine mouth" thermal plants to reduce coal hauling;

(*c*) Sharply reduce station construction times, especially on large hydro plants;

(*d*) Develop higher capacity transmission systems;

(*e*) Accelerate the development of 600-megawatt boilers and turbogenerators;

(*f*) Expand the domestic power equipment manufacturing industry; and

(*g*) Engage in a consistent and planned import of complete foreign powerplants and equipment.

INTRODUCTION

The Energy Base

The People's Republic of China is the fourth largest producer of primary energy in the world after the United States, the Soviet Union, and Saudi Arabia. Output is about one-fifth that of the United States and one-third that of the Soviet Union. It also ranks fourth in the consumption of energy after the United States, the U.S.S.R., and Japan. Reserves of energy are among the most extensive in the world and are still in a relatively early stage of exploitation. The hydroelectric potential is the greatest in the world and coal reserves are third after the United States and the U.S.S.R. China has been awakened to the size and potential of its petroleum resources only in the past 15 years. To this day it is doubtful if the People's Republic of China has a full and accurate appraisal of the extent of its petroleum reserves. Information available outside of China on natural gas reserves is sketchy.

The hydroelectric potential of the People's Republic of China has been given recently as 540,000 megawatts (MW) located principally in Tibet and in the mountainous southwestern provinces.[1] The Yangtze River alone constitutes about 40 percent of the potential. To the north of the Yangtze in drier regions lies the Yellow River with the most developed hydroelectric facilities, but with only 5 percent of the runoff of the Yangtze. Currently, only about 1 percent of China's primary energy supply is derived from hydro resources, placing China 12th in the world in hydroelectric power generation; production is about 14 percent of the United States, the world leader.

Coal has long been China's traditional source of energy. Proven reserves run about 80 billion metric tons and are located in many parts of the country, but principally north of the Yangtze River. Although development of the industry has been hampered by inadequate investment, coal production was 450 million metric tons in 1976 and was around 500 million tons in 1977. Recent investments in foreign mining equipment indicate that some priority is now being given this industry, but it will take years to bring productivity up to world standards. Coal now supplies about two-thirds of the primary energy of the People's Republic of China. Such minor fuels as peat and firewood are excluded from this energy analysis.

With the opening of the Taching, Shengli, and Takang oil fields in the 1960's, China became an oil producer of world rank running 10th in production in 1976; about 80 percent of a daily production of 1.8 million barrels at the beginning of 1978 came from these three fields. China's onshore reserves of oil are believed to total 40 billion barrels while estimates of offshore reserves are much more speculative, but potentially quite significant. Oil accounts for 23 percent of the energy supply. About 90 percent of the natural gas reserves, estimated at 25 trillion cubic feet, are found in Szechwan Province with the gas share of total energy supply being 10 percent. China ranks fifth in natural gas production, but output is only about 7 percent of the world leader, again the United States.[2]

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[1] Hydro reserves that are technically feasible to develop are thought to be about half of this. Relevant figures for the United States are 390,000 and 179,000 megawatts.

DEVELOPMENT OF THE INDUSTRY (1949–75)

Early Stages

The economy of China was severely damaged by the Sino-Japanese War (1937–45) and by the civil war that ensued after the close of World War II and up until 1949 when Communist forces consolidated control over the country. Industrial production was reduced, agriculture was curtailed and the transport system disrupted. After the Japanese surrendered to the Russians in Manchuria in 1945, the Soviets dismantled heavy industrial facilities and shipped the equipment back to the U.S.S.R. Surveys later showed that about 50 percent of the Manchurian industrial capacity was affected in this way. Included in these shipments were about 1,000 megawatts of turbogenerating capacity, including both thermal and hydro units. By December 31, 1949, the total installed electric power generating capacity of the People's Republic of China stood at only 1,800 megawatts, down from the 1944 peak of 3,100 megawatts.[3] Thus, China's electric power generating capability at the end of the revolution was less than the present capacity of the Grand Coulee hydroelectric station or the Kansas City Power & Light Co.

As the Chinese leadership surveyed the task ahead, they were quite aware of Lenin's dicta that "communism equals Soviet power (strength) plus electrification" and "without an electrification plan we cannot carry out real construction." Later, in a 1958 directive, Chairman Mao put it more simply when he said, "electric power is the pioneer of the national economy."[4] The years 1949–51 were devoted primarily to restoring order in the economy and in the power industry preparatory to the planned development under the first 5-year plan.

China's first 5-year plan (1952–57) projected additions of new capacity of 2,050 megawatts or a doubling of the installed capacity at the end of 1952. The actual additions turned out to be about 2,900 megawatts, well above plan. Of this, new units at the Tafengman and Supung hydrostations in the Northeast to replace those removed by the Soviets totaled 600 megawatts. The feat of more than doubling capacity was accomplished by significant help from the Soviet Union, Czechoslovakia, and East Germany who supplied turbines and generators and who established power-generating equipment production facilities which, even today, remain the backbone of the Chinese equipment supply capability. By the end of 1957, installed capacity reached 4,900 megawatts; 1,000 megawatts of which were in hydroelectric facilities. China's electric power generating capacity for selected years is shown in Table 1.

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[2] For details on China's primary energy base, see Vaclav Smil elsewhere in this volume. Also see U.S. Congress, Committee on Energy and National Resources, Project Interdependence, U.S. and World Energy Outlook Through 1990, 1978. For other selected readings on the power industry of China, see the bibliography, appendix 1.

[3] John Ashton, Development of Electric Energy Resources in Communist China, JEC 1967, p. 303.

[4] FBIS, Nov. 10, 1977, E13.

TABLE 1.—ELECTRIC POWER GENERATING CAPACITY, 1949–77 [1]

[In thousand megawatts]

Year [3]	Capacity	Year [2]	Capacity
1949	1.8	1971	21.1
1952	2.0	1972	23.6
1957	4.9	1973	26.8
1961	10.7	1974	30.0
1965	11.8	1975	34.0
1966	13.8	1976	36.9
1970	19.4	1977	40.5

[1] Power generated is 3-phase, 50 hertz at main stations; small plants are generally single phase.

[2] CIA, "Handbook of Economic Statistics, September 1977, p. 87, and older volumes. Estimates for 1976 and 1977 by the author are discussed in the section on the current situation.

[3] Dec. 31 of the year cited.

The Great Leap Forward

At the close of the first 5-year plan in December 1957, the People's Republic of China began the great leap forward phase of economic development. In an attempt to move the economy forward at extraordinary rates of growth, power generation during 1958–60 was to increase at 18 percent per annum. At this time, plans called for a large number of new hydroelectric stations, some of 1,000 megawatts, but most were never started and some that were, like Liuchia and Tanchiangkou were not completed until after 1970. Generating capacity in 1958 and 1959 was nearly doubled, however, with the addition of 4,500 megawatts.[5]

Soviet aid continued during the great leap, but the excesses of the program soon began to disrupt the economy. As a result, by 1960 a severe slump had set in as production dropped. Difficulties were compounded by the decision of the U.S.S.R. to withdraw all of its assistance, including personnel and by the end of the summer of 1960, the Russians were gone.

Output of power is estimated to have dropped from 47 to 31 billion kilowatt-hours between 1960 and 1961, a decline of 34 percent. If accurate, this decline illustrates the severity of the depression following the great leap forward. Six years elapsed before the 1960 level of output was again attained.[6] Additions to generating capacity 1960–65 were only 2,600 megawatts, an average of just over 500 megawatts annually. Recovery was well underway by the midsixties only to receive another setback with the onset of the cultural revolution in 1966. By 1968, however, production rose sharply and growth of power output in the period 1968–70 grew at an average annual rate of 17 percent.[7]

Resumption of Growth

The beginning of the seventies saw attainment of a new level of confidence in Chinese power development capabilities. The void left by the Soviet departure in 1960 had been overcome or to paraphrase Chairman Mao, the Chinese electric power industry "had stood up." The manufacture of basic units such as 100 megawatts turbogenerators had matured. The first large generators for long-deferred major hydro projects had become operational.

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[5] Ibid.

[6] CIA, "China: Economic Indicators," October 1977, p. 1 and older volumes.

[7] Ibid.

The fourth 5-year plan (1971–75) projected the further development of still larger turbogenerators and of higher voltage transmission lines. New power generating equipment manufacturing facilities were to be erected in the interior. To accelerate growth during this period, the PRC leadership made a decision to import significant quantities of plant and technology including electric power stations. During the period 1972–75 about $2.8 billion in foreign plants were contracted for.

Contracts with foreign suppliers in the power sector approached $350 million and upon completion will add about 4,500 megawatts to capacity. These foreign purchases are shown in Table 2. During the 1971–75 period, the expansion of generating capacity was uneven but averaged about 11 percent annually.[8]

TABLE 2.—*Electric power generating plant and equipment purchased by China, 1972–76*

Thermal station turbo-generators

U.S.S.R.—1972: 4 units at 75 MW each; $8.2 million.

U.S.S.R.—1973: 7 units at 100 MW each; $16.7 million.

U.S.S.R.—1974: 1 unit at 200 MW; $2.7 million.

U.S.S.R.—1975: 2 units at 200 MW each; $6.8 million.

U.S.S.R.—1976: 2 units at 200 MW each; about $7.0 million.

Czechoslovakia—1974: 3 units at 100 MW each.

Italy—1972: 1 unit at 125 MW; supplied by Gruppa Industrie Elettromeccaniche (GIE)—over $8 million.

Italy—1974: 2 units at 320 MW; oil-fired plant under construction at Tientsin, December 1975; value about $79 million.

Japan—1972: 2 units at 125 MW each; supplied by Hitachi; operation scheduled for 1975; value, $30 million.

Japan—1973: 2 units at 250 MW each; supplied by Hitachi; operation at Tangshan originally scheduled for 1975; value, $72 million.

France/Switzerland—1974: 1 unit at 300 MW brown coal-fired plant supplied by CEM/France and Sulzer and Brown Boveri/Switzerland; transaction is 70 percent French; operation scheduled for mid-1976; value, about $55 million.

France—1972: 2 units at 60 MW each; supplied by Alsthom-Neyrpic and Creusot-Loire; delivery scheduled 1975; value $10 million.

Sweden: 3 units supplied by ASEA; went into operation 1974; value, $4 million.

Gas turbines and generators

United Kingdom—1972: 5 units at 20 MW each; supplied by John Brown Ltd· (G. E. licensee); in use for base and peak load service, value $8.2 million.

United Kingdom—1973: 3 units at 20 MW each; supplied by John Brown Ltd.; at least one unit in use for mechanical drive, not power generation; value $8.2 million.

Belgium/Canada: 3 units at 8.5 MW each; supplied by ACEC/Belgium and Westinghouse/Canada (Model W–101–G); for base load service; delivered 1975; value $5 million.

Japan—1975: 2 units at 25 MW each; supplied by Hitachi (Type F–5); delivered 1976; value $5.2 million.

Canada—1973: 2 rail mobile units at 9 MW each; supplied by Orenda Division of Hawker Siddeley; arrived in PRC 1975; value $5–6 million.

Organization

The electric power industry of China is controlled from Peking by the Ministry of Water Conservancy and Electric Power, although daily operations are managed by provincial power management bureaus.[9] A significant amount of local control is exercised at the prefecture and county level among the medium- and small-sized plants. The thousands of small hydros that dot the countryside, unlike other small-scale industries in China, are controlled by an electric power and water conservancy bureau probably at the level necessary to effect unified control over water use. This would not be at the commune or brigade level, but at the county level and often probably much higher, including the province. Although operated at the commune or brigade level, the small hydros are required to feed the power they generate into the area's state power grid. The operators of the small stations get paid for the power they supply to the grid, but the commune in turn must pay for the power it consumes.[10]

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[8] It should be noted that $350 million is an insufficient amount to buy 4,500 megawatts of capacity as complete thermal power stations. The units sold to the People's Republic of China by the U.S.S.R. and Czechoslovakia are turbogenerator sets only. The four complete thermal stations sold to China range in cost from $120 to $183 per kilowatt of capacity added. To add 4,500 megawatts of capacity as complete plants would entail an outlay of $550 million or more.

[9] At the beginning of 1978 the Minister was Madame Chien Cheng-ying.

The electric power industry is no exception to the policy followed in various other sectors of the economy known as walking on two legs. That is, parallel with the erection of relatively modern, large- and medium-sized central thermal stations and hydroelectric plants is the construction of simple, small scale, relatively inefficient facilities. The number of these small stations is very large and by 1976 totaled 60,000 with additions possibly being made at the rate of 5,000 annually. At the beginning of 1978, therefore, the PRC may have had 65,000 small hydros. By 1980 the installed capacity of these small hydros is expected to double.[11]

The great increase in these facilities since 1965, mostly hydro units whose average capacity is only 50–100 kilowatts—kW—came about with the development of rural water conservation projects and the need in rural areas for power for agriculture and for the many, locally operated, small-scale industries. About 80 percent of these small stations are found in the eight water-rich southern provinces of the PRC; Kwangtung leads with over 12,000 hydros.

Technological Base

In a general sense, the technological level represented by the Chinese electric power industry trails that in the industrialized countries by more than 20 years. This lag can be seen in the scale of plant, the size of generating units, in the capacity of transmission lines, and in the near absence of interconnected systems and the creation of power pools.[12] It can also be seen in the design of equipment, in the near absence of gas turbines, in less sophisticated instrumentation, in centralized control of thermal stations, in power dispatch and load management, and in the absence of nuclear power stations. The real question, of course, is not so much the current technological lag, but the willingness and the ability of the Chinese to accelerate technological growth in the years ahead based on proven power industry technologies available from the industrialized countries. (See section on prospects.)

If the Chinese were to publicly report some meaningful operational data about their electric utilities, it would probably reveal additional problems associated with an inadequate technological base. There are, for example, reports by visitors to the PRC of serious voltage drops and frequency fluctuations in the power supply. Such drops in voltages and frequencies probably indicate that the demand for power is greater than the generating capacity in the grid. There is some indication that to try and meet demand the Chinese keep an unusually high percentage of available capacity operating in base load service.

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[10] "Rural Small Scale Industry in the People's Republic of China," University of California Press, 1977, p. 107.

[11] FBIS, Jan. 31, 1978, E20.

[12] Largest thermal station: United States, 3,199 MW; and PRC–713 MW. Largest hydroelectric station: United States, 2,195 MW; and PRC, 1,225 MW. Largest turbo-generator: United States, 1,300 MW and PRC, 300 MW. Largest transmission voltages: United States, 750 kilovolts (kV); and PRC, 330 kV.

Voltage and frequency variations can be damaging to electrical machinery and the lack of control can pose dangerous problems of stability in the grid and in the transfer of power to connecting systems. Moreover, there would appear to be insufficient reserve capacity to meet peak demand. All of these factors are probably the concern behind a July 1977 commentary from Shanghai which stated, "Because of excessive consumption, the power network is overloaded, thus affecting power generation. If such a situation is allowed to continue, it will bring serious harm to the power network." And from Kiangsi Province, "We must strive—to achieve safety." [13] Conversely, in Shantung province where major additions to capacity have been made in the past few years, the statement is made that "the level of safe and economic operation is steadily rising." This is taken to mean that it has been possible to raise reserve capacity in Shantung.[14]

The technological feat in the power field that the Chinese have praised most has been the development of water-cooled rotors and stators for their 125- to 300-megawatt turbogenerators (the 125-megawatt stator is air cooled). Although such a development leads to smaller sized generators, there are difficult engineering problems to be overcome, for example, nonmagnetic stainless steel rotor end shields. It is not clear why the Chinese went to this development that has not been found necessary in the West in these relatively small-sized generators. One possible explanation is that Chinese metallurgical and metalworking practices are not sufficiently well developed to handle the large shafts necessary (hydrogen embrittlement in the shafting can cause catastrophic destruction).[15] An insufficient number of the new 300-megawatt turbogenerators with distilled water-cooled rotors are in operation to prove that all developmental problems have been solved. Nevertheless, the development of water-cooled rotor turbogenerators indicates a noteworthy Chinese engineering and design capability.[16]

The PRC should take pride in the substantial technical growth that has been made since 1949 in bringing generating capacity from 1,800 megawatts up to 40,500 megawatts on December 31, 1977. The steady technical progress made over this span of years may be seen in the milestones of achievement shown in Table 3.

TABLE 3.—*Milestones in Chinese electric power development*

1952	First 3-MW electric generator.
1953	First 6-MW hydrogenerator set.
	First 44-KV/20,000-kVA transformer.
1954	First 6 MW steam turbogenerator set.
	First 154-kV/20,000-kVA transformer.

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[13] FBIS, July 29, 1977, G2. FBIS, September 30, 1977, G4.

[14] Chung-kuo Hsin-wen, Hong Kong, January 21, 1976, p. 1.

[15] For example, People's Daily on Oct. 30, 1977, said, "the quantity of large forged pieces (rotors) for power stations was unable to meet the demand for protracted periods of time. Do we lack the ability to turn out such pieces? No. Are we ignorant of the advanced techniques in the production of large forged pieces? No. The major reason is low quality in production."

[16] A large-scale model of the 300 megawatt unit at the Shanghai Industrial Exhibition shows this 3,000 rpm model GFS-300-2 to consist of a 9-stage high-pressure turbine, an 11-stage medium pressure turbine, and 2 double-expansion low-pressure turbines, each with 2 6-stage turbines.

TABLE 3.—*Milestones in Chinese electric power development*—Continued

1955	First 40-ton/hr steam boiler.
	First 10-MW hydrogenerator set.
	First 120-kV/31,500-kVA transformer.
1956	First 12-MW steam turbogenerator set.
	First 15-MW hydrogenerator set.
	First 3.5-kV high-tension cable.
1957	First 130-ton/hr steam boiler.
	First 220-kV/20,000-kVA single-phase transformer.
1958	First 110-kV/60,000-kVA 3-phase transformer.
	First 220-kV/40,000-kVA single-phase transformer.
	First 220-kV oil-filled high-tension cable.
1959	First 50-MW steam turbogenerator.
	First 72.5-MW generator for hydro use.
1960	First 230-ton/hr high-temperature and pressure steam boiler.
	First 50-MW high-temperature and pressure steam turbine.
1965	First silicon-controlled rectifier.
	First 500-kV standard condensor.
	First 6-MW gas turbine.
	First 220-kV air circuit breaker.
	First 330-kV rod insulator.
1966	First 125-MW hydrogenerator set.
	First 100-MW steam turbogenerator with water-cooled rotor and stator.
	First 100-MW hydrogenerator set.
	First 1,000-kV standard condensor.
	First 330-kV suspension-type insulator.
	First 1,000-kV standard condensor.
1968	First 150-MW generator for hydro use operational at Tanchiangkou.
	Initial construction of 300-MW hydroelectric turbogenerator at Harbin.
	First variable control transformer.
	First 110-kV underwater cable.
1969	First 125-MW steam turbogenerator with water-cooled rotor and stator.
	First 225-MW generator for hydro use operational at Liuchia.
	First 330-kV high-tension cable.
	First 250-kV transformer.
1970	First 60,000-kVA transformer.
	First 110-kV aluminum cable current sensor.
	First 154-kV high-tension cable fault detector.
1971	First 60-MW hydrogenerator set for low head.
	Initial construction of 200-MW steam turbogenerator with water-cooled rotor and stator.
	First experimental geothermal power generator operational at 86 kW.
	Initial construction of 300-MW steam turbogenerator with water-cooled rotor and stator.
	First 750-kVA, 3-phase, water-cooled transformer.
	First 15,000-kVA water-cooled transformer.
1972	First 220-kV/300,000-kVA aluminum-wound transformer.
	First transmission of power at 330 kV over short distances.
1973	First 300-MW hydrogenerator set with water-cooled rotor and stator operational.
	First 11-MW pumped storage facility.
1974	First power station in China with over 1,000 MW capacity into operation.
	First 330-kV mutual inductance voltage transformer.
	First sodium hexafluoride high-voltage standard condensor.
	First 670-ton/hr super high-pressure boiler for 200-MW steam turbines.
	First use of gas turbine exhaust heat to preheat boiler feedwater.
1975	First computer control of a 100-MW steam turbogenerator.
	First 10-MW gas turbine for power generation.
	First 200-MW steam turbogenerator operational at the Chinghsi station, Peking.
	First 330-kV high-tension transmission line completed, 534 km long.
1976	First 300-MW steam turbogenerator operational at the Wangting station, Wuhsi.
1977	Initial construction of 600-MW generators at Harbin.
	Initial construction of 600-MW subcritical power boilers at Harbin.

Regional Power Capacity

At the close of the revolution in 1949, the PRC's power industry was centered in the three provinces of the northeast and in the coastal areas. The first 5-year plan policy of locating industry as close to raw material and fuel sources as to centers of consumption promoted the dispersion of industry away from the coast. To support the industrial growth, centers of power also had to be established in the inland provinces which led to the development of a power industry in all of China's provinces. Table 4 indicates the approximate portion of generating capacity to be found in each province at the end of 1977.

TABLE 4.—ELECTRIC POWER GENERATING CAPACITY BY PROVINCE, DEC. 31, 1977

Province	Share (percent)	Province	Share (percent)
Anhwei	4.8	Kweichow	2.2
Chekiang	5.1	Liaoning	9.5
Fukien	1.8	Ningsia	.8
Heilungchiang	3.1	Peking	4.1
Honan	3.2	Shanghai	4.0
Hopeh	4.0	Shansi	2.6
Hunan	2.4	Shantung	6.1
Hupeh	5.7	Shensi	2.4
Inner Mongolia	1.1	Sinkiang	.6
Kansu	8.1	Szechwan	6.8
Kiangsi	1.4	Tibet	.2
Kiangsu	4.1	Tientsin	1.6
Kirin	4.3	Tsinghai	.3
Kwangsi	1.8	Yunnan	2.2
Kwangtung	5.7		

Since 1970 power systems in some provinces have undergone rapid expansion. Between 1970 and 1977, about 1,340 MW of capacity were added in Shantung to support the growth of industry which brought the province from 11th to 4th place. Completion of major hydro facilities on the Yellow and Han Rivers has significantly increased capacity in Kansu and Hupeh Provinces. Liaoning remains the province with the greatest capacity with Kansu, Szechwan, and Shantung following in that order.

Power Generation and Demand

Information available does not permit an accurate or detailed picture of the demand for electric power in China for recent years, although it has been clear for some time that demand has not been fully met. Estimates show that industry consumes about 62 percent of the primary energy generated with approximately 6 percent used for agriculture, 5 percent for transport, and 27 percent commercial and residential use.[17]

Of the 6 percent consumed by agriculture, a major share is produced by the thousands of small hydroelectric facilities found in the PRC. In addition to pumping for irrigation purposes, electric power is required on China's many communes to support repair facilities, small industrial establishments, and the increasing mechanization of agriculture.

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[17] *Project Interdependence,* in the work cited in footnote 2.

During 1975, it is estimated that China generated about 121 billion kilowatt-hours. While this was sufficient to put the PRC in ninth place in the world, the annual per capita consumption at 130 kilowatt-hours is very low and only on a level with the poorer developing countries. Power generated in selected years is shown in Table 5.

TABLE 5.—GENERATION OF ELECTRIC POWER IN THE PRC [1]

[In billion kilowatt-hours]

Year	Generation	Year	Generation
1949	4.3	1972	93.0
1952	7.3	1973	101
1957	19.3	1974	108
1961	31.0	1975	121
1965	42.0	1976	124
1970	72.0	1977	136
1971	86.0		

[1] Handbook, op. cit.

Very little of the power generated is exported although some transfer has occurred with North Korea; the last reported figures show that in 1956 the PRC exported 154 million kilowatt-hours and in 1958 they imported 400 million kilowatt-hours. The PRC and North Korea also share the output of several hydroelectric facilities on the Yalu River.

China does not publish sufficient information to permit estimates of the average demand or load on powerplants and systems. Plant factors (ratio of average power load to rated capacity) usually cannot be determined. One measure of efficiency is the annual hours the rated capacity must be operated to produce the kilowatt-hours of power generated. In 1962 when the lack of demand idled industrial capacity following the Great Leap Forward, the annual hours of operation dropped below 2,800. Hours of operation for thermal and hydro stations differ markedly. At times of low water or when the demands of irrigation are high, the operation of small hydro facilities can drop below 2,000 hours per year. By 1976 and 1977, this hourly figure of merit was estimated at 3,500 and 3,525 hours, respectively.[18]

Transmission of Power

The most important electric power grids in the PRC are located in the northeast (centered on Liaoning and Kirin), north (centered on Peking, Tientsin, and Tangshan) and east (centered in the Shanghai area). Provincial grids are gradually being expanded to cover most important centers of power consumption in Kwangtung, Hupeh, and Shantung. China's longest transmission link runs from Yumen in the northeast through Lanchou to Chengchou in the east. The portion from Lanchou running 333 miles to Paochi is the PRC's only 330 kilovolt line; first power was transmitted in 1972. To further develop China's hydro potential properly, higher voltage transmission will have to be employed, probably on the order of 500 kilovolts. Development is underway. Interchange capabilities will have to be expanded (the key northeast and north grids are linked by a single 110 kilovolt line so the interchange is limited).[19]

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[18] See appendix 3 for more detail on hours of operation.

[19] For additional detail on China's transmission lines see appendix 2.

CURRENT SITUATION (1976–1978)

The Power Shortage

In the early fall of 1977, Chairman Hua Kuo-feng issued a series of state directives giving the development of electric power a position of high priority. In stressing the need to conserve electric power, to utilize capacity more fully, and to generate power more efficiently, Hua was clearly indicating that all was not well within the Chinese power industry.

That China has been short of power for years was evident from official statements, from reports of visitors, from staggered hours of industrial operations and from a nationwide campaign that preached conservation. But now recognition was being given the fact that if the ambitious program to modernize agriculture, industry, science and technology, and national defense by the year 2000 was not to be jeopardized, the existing situation in the power industry would have to be rectified quickly. The seriousness of this problem was underscored by the November 1977 statement from Peking that "solving the notable contradiction (shortage) of supply and demand of electric power has become an important task facing the new leap forward in the national economy * * * present contradictions in supply and demand are fairly large and have directly affected the development of industrial and agricultural production."[20]

Perhaps one of the clearest indications of the immediate concern for power supplies came in December at the Miyun reservoir near Peking, when Chairman Hua said, "it (the reservoir's water) must first be used to generate electricity and then to irrigate the land." This appears to reverse the generally held first priority accorded the production of agricultural products. The Chairman had told the Minister of Water Conservancy and Electric Power that "power output must be increased by fully utilizing hydroelectric power and that when increased power output is achieved throughout the country, the gross value of industrial output will be greatly enhanced without even increasing the amount of industrial equipment."[21]

Causes

The causes of the current situation are primarily attributable to years of insufficient investment in the electric power industry and in the supporting fuel and rail transport sectors. Investment in mine development, mine mechanization, and coal preparation facilities has lagged for many years. The destruction at the important underground Kailuan mines in Tangshan resulting from the July 1976 earthquake also impaired supplies. While coal output is now around 500 million metric tons annually, the Chinese rail system and the fleet of rolling stock are not up to the task of expeditiously moving coal from mines to power plants. The rapid development of the Chinese petroleum industry and the conversion of some thermal stations to the firing of oil has somewhat eased the coal bottleneck.

In the power industry, itself, capital construction plans have gone unfulfilled and the number of turbine and generator sets to be placed on-line has fallen short. Maintenance of plant and equipment has been neglected, in part due to the failure to create the normal reserve generating units commonly found in the developed industrial countries. This has resulted in overuse of units in base load service and an inability to meet loads at time of peak demand. The limited number of transmission lines and the absence of many interprovincial power grid connections have caused problems of load management that has resulted in outages. All of these factors have brought the safety and reliability of the Chinese power system into question.

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[20] FBIS, Dec. 2, 1977, E1.
[21] Ibid.

Short Term Solution

To ameliorate the immediate shortcomings of the industry and to provide the basis in 1978 for an acceleration of power growth by 1980, Chairman Hau's directives focus particularly on conservation and full utilization of generating capacity. To balance supply and demand with the needs of the national economy, a specific planned power consumption quota emphasizing conservation will be assigned each and every urban and rural area, enterprise, workshop, and work unit.[22] Based on experiences in the important northeast power grid (Liaoning, Kirin, and Heilungkiang Provinces), a careful, planned program can result in a 10-percent reduction in consumption.[23]

Additionally, attempts will be made to utilize more fully existing capacity, although it would appear that in some cases this will come in conflict with the need to take equipment off-line for maintenance and it will interfere with the creation of adequate reserve capacity. As noted earlier, the greater utilization of hydroelectric facilities may also interfere with irrigation and agricultural production. Finally, equipment is to be used more efficiently and coal and oil conserved.

Power Capacity and Generation

In both 1976 and 1977, the capacity of the Chinese power industry increased substantially. In 1977 over 40 large and medium-sized hydro and thermal power generating units having a considerably greater generating capacity than those built in 1976 were put in operation. Information concerning the commissioning of a number of individual turbo-generator units has been released by Peking. The capacity estimated to have been added in turbo-generators of all sizes was about 2,900 and 3,600 megawatts in 1976 and 1977, respectively. Based on an 8.5-percent growth in 1976 and 9.8 percent in 1977, generating capacities at the end of 1976 and 1977 are estimated at 36.9 and 40.5 thousand megawatts. U.S. capacity at the end of 1976 was 531.3 thousand megawatts.[24]

How this installed generating capacity was used in 1976 and 1977 to produce power was highly dependent on the rate of industrial growth. Apparently, there was no industrial growth in 1976.[25] Despite this, more power was produced, probably because the industry had not been fully meeting demand in 1975.[26] Shantung, in fact, generated 20 percent more power in 1976 than in 1975.[27] Power generated in the

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[22] FBIS, Oct. 21, 1977, L3.
[23] FBIS, Nov. 14, 1977, E8.
[24] For additional detail on estimating generating capacity in 1976 and 1977, see appendix 3.
[25] Indicators, Op. Cit.[7]
[26] FBIS, Jan. 12, 1977, E20.
[27] FBIS, July 15, 1977, E17.

PRC in 1976 was an estimated 124 billion kilowatt-hours, an increase of 2.5 percent over 1975. Power generated in the United States in 1976 amounted to just over 2 trillion kilowatt-hours.

The year 1977 witnessed a reported 14 percent increase in industrial output.[28] Some of this growth, of course, was simply reactivation of capacity idled by the political turmoil of 1976 when plants in various industries were shut down, in some cases for extended periods. During the first 6 months of 1977, power output set a record high; 6 of the 11 largest power systems surpassed all previous records. Although China's plan for power was fulfilled by December 12, 1977, shortages persisted. During the period July-October 1977, Hofei, capital of Anhwei Province, suffered a "30 percent power shortage" despite being tied into the East grid.[29] For 1977, power generated ran an estimated 136 billion kilowatt-hours or an increase of 9.8 percent over 1976.[30]

At the end of 1977, thermal electric stations had 62 percent (25.1 thousand megawatts) of the PRC's total power generating capacity while hydroelectric plants contained nearly 38 percent (15.2 thousand megawatts). This represents a further increase in hydro's share compared to most earlier reports. With emphasis now to be placed on the further development of hydraulic resources, this figure can be expected to rise slowly. In the short term, thermal capacity, which can be brought on line more quickly, may rise faster, but the long-term trend is toward placing a greater share of the industry in hydroelectric capacity.

The larger share of power generated, however, continues to be principally from thermal stations. During 1977, an estimated 71 percent of all power produced came from these facilities, about 96.6 billion kilowatt-hours. The reason that hydroelectric stations with 38 percent of the capacity produced only 29 percent of the power is attributable to the reduced hours of operation stemming from low water and irrigation and other demands on the water resource. This natural feature of hydroelectric operations may be improved on some as the share of hydro capacity in larger dams increases and if the priority use of water in reservoirs is accorded to power generation as suggested by Chairman Hua in December 1977.

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[28] FBIS, Dec. 27, 1977, E8 (11 mos. growth was 13.7 percent).

[29] Lbid. Also Peking NCNA Domestic Service, Nov. 24, 1977.

[30] FBIS, Dec. 27, 1977, E9 (For additional detail on estimates of power, produced in 1976 and 1977, see Appendix 3).

Hydroelectric Stations

There are 66 known hydroelectric stations in China of 30 MW capacity and greater, of which 7 are under construction and have produced no power. These 59 operative stations comprised about two-thirds of the hydroelectric capacity at the end of 1977 while the balance consists of the 65,000 or so small and medium size hydros. Because of the completion of a number of major dams on the Yellow and Han Rivers and because of the large increase in small hydros, the share of capacity held by hydroelectric stations has been rising in recent years.

In 1974, there were some 73 concrete and 438 stone masonry dams, 15 meters (49′) or higher in China and more than 250 reservoirs with storage in excess of 100 million cubic meters (35.3 billion cu. ft.) of water. In addition to power generation, Chinese dams are designed with irrigation, flood control, and enhanced river navigation in mind. Fish breeding and water for municipal use are also factors.

Liuchia and Tanchiangkou are China's two largest hydroelectric plants and are among the newest constructed, being completed in 1974 and 1973, respectively. Liuchia, the largest powerplant in the PRC, is in Kansu on the Yellow River above Lanchou. This Chinese designed and equipped facility has a powerhouse with one 300 MW and four 225 MW units providing a rated capacity of 1,225 MW. It supplies power to several 220 kV lines and China's only 330 kV line. Liuchia is nominally capable of delivering about 5.7 billion kilowatt-hours per year, an annual rate of operation of 4,643 hours. Started at the time of the Great Leap Forward, construction at Liuchia was long deferred and the facility did not deliver its first power until 1969.

Tanchiangkou was also started in the late fifties with the first generator not being put on line until 1968. The sixth and last 150 MW generator was turned over in 1973. This Chinese-designed and equipped facility is located on the Han River about 430 miles above its confluence with the Yangtze at Wuhan in Hupeh. Tanchiangkou's 900 MW capacity, second largest in the PRC, provides a major share of the power needed in Hupeh.

The Sanmen dam on the Yellow River, designed by the Soviets, has been revamped by the Chinese and will not reach its originally intended capacity of 1,080 MW. The Yellow River's silt load, heaviest in the world, forced a revision in the dam and the installation of specially-designed smaller turbines of 50 MW each. Several turbines are thought to be operating and a total of either four or five will be installed giving the facility a capacity of 200 or 250 MW.

China has nine hydroelectric stations with capacities of 300 MW and greater; two more are at 290 MW. Two of these are on the Yalu River where the output is believed to be shared 50–50 with North Korea; operations are controlled by the China-Korea Yalu River Hydroelectric Power Co. The hydro stations of 300 MW or more and the major systems of dams, including cascade systems, are shown in Table 6. A brief description of each hydroelectric station may be found in Appendix 4.

Table 6.—*Major Chinese hydroelectric systems*

	Megawatts
Yellow River (moving upstream):	
Sanmen, Honan	[1] 150.0
Tienchiao Shensi	[1] 50.0
Shihtsuishan, Ningsia	(2)
Chingtung, Ningsia	225.0
Papan, Kansu	180.0
Yenkuo, Kansu	300.0
Liuchia, Kansu	1,225.0
Lungyen, Tsinghai	(2)
Yalu River (moving upstream):	
Supung Dong Sui, Liaoning	700.0
Hulutao Unbong, Kirin	400.0
Sungari River: Tafengman, Kirin	590.0
Han River and tributaries (moving upstream from the Yangtze River):	
Tanchiangkou, Hupeh	900.0
Huanglungtan, Hupeh	150.0
Shihchuan, Shensi	135.0
Tatu River: Kungtsui, Szechwan	508.0
Yangtze River: Three gorge area, Szechwan/Hupeh	(2)
Fuchun River and tributaries (moving upstream):	
Fuchun, Chekiang	260.0
Chililung, Chekiang	420.0
Hsinan, Chekiang	652.5
Cascade systems:	
Kutien, Fukien (4 stages)	158.0
Maotiao, Kweichow (6 stages)	250.0
Lungchi, Szechwan (4 stages)	108.0
Ili, Yunnan (4 stages)	172.0

[1] Partial capacity.
[2] Under construction.

The drive to assist the modernization of agriculture and to bring electricity to China's rural communes from small hydroelectric plants saw its greatest surge in the past 7 years when the number of small hydros grew from 15,000 to about 65,000. Typically, these stations average only 50 kilowatts in capacity, and some are as small as several kilowatts. In the miniturbine range, the Tientsin Electric Gear-Drive Design Institute has designed seven models from 250 watts to 12 kilowatts which can be manufactured on the commune itself. Although inefficient compared to larger units, both in hours of operation and in cost per installed kilowatt of capacity, China's small hydros have a major impact on the local economy providing flood control, irrigation, and some power without making demands on major production facilities or on the underdeveloped power transmission systems.

Thermal Powerplants

There are 126 known fossil-fueled thermal electric power stations in China with capacities of 30 MW and higher, of which seven are under construction and are not believed to have produced any power in 1977. Currently, the Wangting station in Wuhsi at over 700 MW is the largest. There are no nuclear-powered thermal power plants.About 75 percent of all thermal stations are fired with coal ranging from lignite through bituminous types to anthracite. The rest of the plants are oil-fired, although a few units in Szechwan are gas-fired. A number of units have been converted to coal and oil-firing or oil-firing alone to ease the coal supply bottleneck.

The coal most widely used in raising steam at thermal plants is a sub-bituminous type with heating values running from 3,000 to 5,000 kilocalories per kilogram. Lignites will continue to be used as seen in the erection of the Swiss/French-supplied thermal station. Coal consumption per kilowatt-hour of power generated has dropped, but no national averages for this indicator of efficiency are available. Recently, the Chinese have talked about blending in 5 to 10 percent of very low grades of 1,000 to 2,000 kilocalorie coal.[31]

A typical oil-fired Chinese thermal station will use Taching, Takang, or Shengli crude. At the Wuching plant in Shanghai, crude from Shengli is fired having a heating value of 10,000 kilocalories and a sulfur content of 1 to 1.8 percent.[32] Taching crude exported to Japan is also often directly used for firing thermal station boilers because its high paraffin content makes processing difficult in Japanese refineries.

For thermal station work, the Chinese appear to have standardized on steam turbogenerators of 25, 50, 75, 100, and 125 kw. These are serially produced. Units of 200 and 300 MW with water-cooled rotors are now being manufactured and are in operation although their numbers are not great and it is questionable whether they can be considered to be in serial production. Initial production is underway at Harbin and probably Shanghai on 600-MW turbo-generators and the associated boilers. Based on past experience, the first 600-MW unit will probably not be online before 1981–82.

There is no evidence of the use of combined cycle plants (where gas turbine exhaust is used to drive a conventional steam turbine) for peaking or intermediate load service. This is the most efficient system for generating electricity from liquid or gaseous fossil fuels, but is probably not found in China owing to the relatively undeveloped nature of power gas turbine production and technology. There is no evidence of significant Chinese development in gas turbines for peaking or baseload service although the Chinese do have some foreign units of this type (see Table 2).

To increase efficiency, the Chinese are utilizing waste heat from hot flue gases and warm cooling water at power stations to heat other industrial plants. Some 120 facilities in Liaoning are using such residual heat. Although not used much in the United States, combined district heat and electric power stations are extensively utilized in Europe, especially in the Soviet Union.

At a Tientsin powerplant, where much of a gas turbine's exhaust heat was formerly wasted, 80 percent is now recovered and used to preheat the feedwater for a steam generating unit. Still, there is a little evidence of the more advanced concept of "energy centers" where steam is delivered to industrial process use after passing through a steam turbine in a central power station or where "byproduct" electricity is produced from excess industrial process steam using an extraction or back-pressure turbine. In Kiangsu at Changchou, one-tenth of the power produced is generated from waste industrial steam, and at the Harbin cement plant a 4.5-MW station uses waste heat to provide one-third of the power needed.

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[31] FBIS, Dec. 15, 1977, E13.

[32] For more detail on a typical Chinese thermal powerplant, see app. 5.

Other sources of electric power under development in China include geothermal units, solar power, and tidal stations. The Chinese have at least four experimental geothermal power generators in operation: Fengshun County, Kwangtung, 86 kW, started in 1971; Ninghsiang County, Hunan, operation stabilized at 300 kW in 1975: Huailai County near Peking, started in 1974; and Yangpaching, Tibet, where the first 1,000-kW unit began producing the high pressure vapor in 1977. Trial projects in both geothermal and solar electric power production are underway at Tientsin University.

There is no significant amount of electric power developed via solar means or from generators based on gas from methane digesters, although 4 million families in Szechwan use digester methane for cooking and heating. In certain localities, these developments could become of some importance.

The Chinese have at least one tidal power station, Kanchutan in Kwangtung, although it is only unidirectional and not a true tidal station. Depending on flow, capacity is 200 to 250 kW.

A brief description of each thermal power station may be found in Appendix 4.

PLANS

The Minister of Power Speaks

The national economic development plan is to modernize agriculture, industry, science, and technology, and national defense in order to propel China into the front ranks of the industrialized nations of the world by the year 2000. Announced by Premier Chou En-lai in January 1975 and revalidated by the important Taching conference in May 1977, this four modernizations program will place a heavy burden on the electric power industry—an industry characterized by Chairman Mao as one of the two "vanguards" (the other is transportation) which must lead in economic development.[33]

That the Chinese are already engaged in preparing this vanguard industry for the difficult task ahead is seen currently in Chairman Hua's directives concerning power development. At no time have actual capacity targets been released, but at the recent National People's Congress, Hua stated that the 10-year plan calls for the building or completion of 30 power stations.[34] As a result of Hua's directives, the convening in December 1977 of a national power conference, and as indicated by the foregoing quotation, a very high priority effort is currently being directed at the acceleration of electric power development in an effort to place the industry in a strong position to support orderly growth of the economy.

Again, without revealing plan targets, the Minister of Water Conservancy and Electric Power, Chien Chen-ying in a significant November 1977 article and later at the national power conference provided some general information on how the PRC plans to develop electric power over the remainder of the 20th century.[35]

The guiding policy laid down by the party and the state council in 1977 stresses the simultaneous development of both hydroelectric and thermoelectric power in large, medium, and small stations. Emphasis is to be given, however, to the creation of large hydroelectric stations as the future backbone of the Chinese power industry.

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[33] FBIS, Sept. 12, 1977, E23.
[34] FBIS, Mar. 7, 1978, D17.
[35] Red Flag, November 1977 and FBIS, Nov. 10, 1977, E13–19.

The Minister spoke pointedly of the need to complement hydro developments with erection of thermal plants in the vicinity of the hydros to meet regional demand when low water and irrigation reduce hydro operations. Expressing concern over the lengthy time required for the construction of hydros; she urged that construction continue in the winter of 1978 through the dry period in order to accelerate by 1 year the introduction of new hydroelectric facilities. While citing long construction times for hydros, she noted the cheaper cost of the power produced from them and the more rapid recovery of investment. Finally, and apparently as a preview of future plans, Minister Chien referred to Premier Chou's earlier call for the building of hydroelectric projects in the three gorges of the Yangtze River astride the Szechwan-Hupeh border.

The construction of thermal electric stations near coal mines, the so-called mine-mouth type of plant, is to be stressed to ease the burden of hauling coal by rail, one of the current problems causing power shortages. This in turn places the burden of transporting energy on the transmission systems which also may be a problem. The need to utilize low-grade forms of coal such as lignite and even peat is to be promoted. Chien cited the need for more thermal powerplants where waste or excess steam is used for heating purposes in adjacent towns and factories; this is extensively done in the Soviet Union but there are only a few such plants in the PRC. At no time did she mention thermal stations based on nuclear power, but there are indications China will soon move into such facilities although they would only play a minor role in the total power picture.

Minister Chien noted the need for increasing the reserve capacity of the industry. In this connection she devoted an entire paragraph to the discussion of safety in the industry as a means of preventing serious damage to the national economy. This is taken to mean plans must recognize the need for a larger reserve capacity to insure stability in the power supply. The need for improved transmission systems coupled with a call for greater automation and mechanization also relates to improved load management and great reliability of supply.

All of the Minister's plan information, although very general, is useful in aiding in the assessment of just what prospects are in store for the Chinese electric power industry.

PROSPECTS

Constraints on Growth

In pushing for rapid development of the economy the Chinese are faced with a number of critical problems: improvement of agricultural productivity; the need for better management and more discipline in the industrial work force; higher wages; better scientific and technical education; and increasing exports to earn foreign exchange to support acquisition of foreign plant and technology. The strengthening of rail transport, the coal industry, and the iron and steel industry, all weak links in the economy, must be accomplished. Coupled with these problems is a need for political stability and relative freedom from natural disasters.[36]

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[36] For more detail on Chinese economic and industrial growth see Field, Chen, and others in this volume.

Understanding plans for industrial growth in a developing country such as China is important because of the close relationship to the demand for electric power. If the electric power industry cannot be developed at a faster pace than industry generally, then industrial growth is likely to be inhibited. As Vice Premier Li Hsien-nien put it in December 1977, "unless the problem of the power supply is solved the national economy cannot possibly grow at a high speed."[37]

In the 23-year period 1952-75, industrial growth in China averaged an estimated 11 percent annually, although in 1976 it was close to zero and in 1977 about 14 percent.[38] In the period 1978 to 1985 and even beyond to the year 2000, industrial growth could average anywhere from 6 to 14 percent annually, depending on the success Peking has in coping with the problems enumerated above. Sustained industrial growth at a higher rate seems unlikely and if it falls even as low as 6 percent, the announced program of modernization could only be considered a partial success.

Growth in Generation Capacity

A study of 12 rapidly industrializing countries in the 1960's showed that to support industrial growth adequately, electric power needs to be advanced about 1.4 times as rapidly. To date, the Chinese experience has been similar with this ratio at 1.6 during the period 1952–75, but dropping to 1.3 times during 1971–75. Using a 1.3 relationship, Table 7 shows what installed generating capacities would be required for selected years in order to support average industrial growth rates of 8, 10, and 12 percent annually over the period to the year 2000.

TABLE 7.—REQUIRED ELECTRIC POWER GENERATING CAPACITY TO SUPPORT INDUSTRIAL GROWTH RATES OF 8 PERCENT, 10 PERCENT, AND 12 PERCENT, SELECTED YEARS

[In thousand megawatts]

	Generating capacity (percent)				Generating capacity (percent)		
Year [1]	8	10	12	Year [1]	8	10	12
1978	44.7	45.8	46.8	1984	81.0	95.3	112
1979	49.4	51.7	54.1	1985	89.4	108.0	129
1980	54.5	58.4	62.6	1986	98.7	122.0	149
1981	60.2	66.0	72.3	1987	109.0	137.0	173
1982	66.4	74.6	83.6	1990	147.0	198.0	267
1983	73.3	84.3	96.7	2000	394.0	673.0	1,140

[1] Dec. 31 of year cited.

At a 10 percent rate of industrial growth—13-percent for the power industry—Table 7 shows that at the end of this year capacity should be 45,800 megawatts, an increase of 5,300 MW over 1977. Construction projects currently underway where turbo-generators appear likely to come on-line in 1978 would contribute about 2,500 MW. Other projects, chiefly hydroelectric where information is sketchy, would contribute additional capacity as would the introduction of many more of the small hydros. The only 300 MW thermal turbo-generators that have been announced as entering production are those at the Wangting station, yet indications are that the Chinese have produced more than this so several more may be operative elsewhere. Still, the total estimated new 1978 capacity from a review of construction projects would not appear to reach the required increment of 5,300 MW needed to sustain 10 percent industrial growth.

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[37] FBIS, Dec. 19, 1977, E2.
[38] *Indicators*, Op. Cit. n. 7 and FBIS, Dec. 27, 1977, E8.

Power Equipment Industry

A review of the Chinese power equipment manufacturing industry reveals a considerable productive capacity. In fact, for many years this industry has appeared to produce more turbo-generator capacity than can be accounted for by annual increments to capacity as reflected by the electric power capacity series or by a power station by station analysis.

The power equipment plants, for example, are estimated to have produced 21,300 megawatts of capacity, 1971–75. During this time, imports of turbo-generators ran at least 1,900 megawatts for a total of 23,000 megawatts. China does export a few small turbo-generators—the largest, a 100 MW unit, went to North Korea. But during the period 1971–76—slipped a year to allow time for equipment installation after manufacture—the electric power capacity series (see Table 1) shows an increase of only 15,800 megawatts or less than 70 percent of the equipment capacity apparently available for installation. Retirement of obsolete facilities would account for only a small part of this. Information is lacking on whether some equipment produced was just not usable. A basic unexplained difference appears to remain. For further discussion of this difference and a review of the power equipment production series see Craig elsewhere in this volume. For additional detail on the manufacturing plants that comprise this industry, see Appendix 6.

From the analysis contained in this study and from the pronouncements of the Chinese leaders concerned with the economy, it appears questionable whether the equipment industry has the capability to supply the capacity needed in 1978 to maintain a 13 percent rate of growth in electric power capacity. It should be noted that long lead time items like turbines and generators had to be laid down in 1976 and 1977, if they are to be shipped to construction sites, installed, and be ready to produce power in 1978, moreover, 1976 was not a good year for industrial production. Additional capacity may be derived from imports, but no turbo-generators were noted in Sino-Soviet trade for 1977, nor were any imports, other than those already mentioned, seen in China's imports from the industrialized West.

Equipment Imports

Shortfalls, therefore, have to be made up by imports. During 1977, one would have expected to hear about negotiations in Peking concerning the purchase of large-scale thermal plants, but such was not known to have been the case, possibly indicative of greater difficulty in retrenching the economy in 1977 and planning for 1978 and beyond than had been thought. While it is assumed negotiations are now underway in Peking, it should be noted that for major projects such as large thermal stations, a contract in 1978 means online power no earlier than 1981–82. Hence, it is hard to see how any new purchases of foreign plants will materially assist in the required increments of electric power capacity until 1981 at the earliest.

1985

Industrial growth of 10 percent would require a power capacity in 1985 of 108,000 megawatts or nearly 2.7 times 1977's generating capacity. The increment to capacity in 1985 of 12,700 megawatts is perhaps even more imposing.[39] This would appear to require a major expansion of power generating equipment manufacturing plant. And it would also require a sustained program of significant imports of foreign plant and equipment, possibly as much as 2,500–3,000 megawatts annually calling for minimal annual outlay of at least $300 million.

At a 10 percent industrial growth rate, Table 7 projects a need in the year 2000 for a generating capacity of 673,000 megawatts. This is less than 50 percent of one estimate of U.S. generating capacity for the same year and reduces the Chinese goal of overtaking the United States economically to an exhortatory call for action.[40]

Assessment

To achieve the four modernizations, the Chinese under the leadership of Chairman Hua and Vice Premier Teng Hsiao-ping plan to achieve at least an annual 10-percent increase in industrial growth by 1980 and sustain it through 1985 and possibly beyond. Given the 8.5-percent and 9.8-percent increases in power generating capacity in 1976 and 1977 and the lead time required to install new capacity, it would appear difficult to accelerate developments to the required 13-percent level prior to 1980. This is one reason why Chairman Hua's directives of late 1977 place such heavy emphasis on conservation and allocation of electric power.

Key features of the effort to increase capacity and power production will have to include:

(*a*) Heavy investment in the development of the coal industry to forestall more thermal plants from being converted from coal to oil firing. This will help maximize the availability of oil for export earnings;

(*b*) Improvement in rail transport to eliminate bottlenecks in coal deliveries and the development of coal-fired, mine-mouth type thermal plants to ease the burden on the rail system. Increased use must be made of locally available low grade coals to reduce the long haul of higher grade coals;

(*c*) Commencement of major hydroelectric developments in the 1,000 MW and greater capacity. This means development of new dams in the main gorges of the Yangtze above Ichang. The first Yangtze River hydroelectric station is under construction now;

(*d*) Reduction in construction time for both hydro and thermal station projects. The 15–16 years spent on Liuchia and Tanchiangkou should be reduced to perhaps 8 years;

(*e*) Development of 500 kV transmission lines to serve centers of consumption far from remote hydro sites. Greater interconnection of grids to provide security for the power supply is essential;

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[39] This is greater than the 11,900 megawatts of capacity the Soviet Union plans to add in 1978.

[40] Federal Power Commission projects 817,000 megawatts for the United States for Dec. 31, 1986. The period 1987–2000 for the United States was taken at a growth rate of 4.5 percent annually.

(*f*) Large thermal stations and units. Work currently underway on 600 boilers and turbo-generators will have to be accelerated;

(*g*) The import of complete one- and two-unit thermal stations in the 600 and 1,200 MW class; and

(*h*) Expansion of the power equipment manufacturing capability.

With their relatively abundant hydraulic resources and reserves of oil and coal, the PRC need not be driven into a rapid nuclear power program. Nevertheless, it seems likely that the Chinese will soon construct or contract for one or more nuclear stations if only to keep up with technological developments. It would also make sense for the Chinese to enter into a technical assistance agreement for the manufacture of gas turbines of 25 MW and higher for both peak shaving and base load service. And while China's self-reliant stance might prevent such a contract, the Chinese would probably benefit greatly from obtaining consultative advice from abroad on numerous aspects of power industry operations.

What is not so evident in the above quantitative analysis of what China may require by 1985 are the changing technological characteristics of the capacity to be added. A major portion of the new capacity will be larger and more complex. Technological problems will require solution as higher operating temperatures and pressures are encountered, as improved process control and environmental equipment are required, and as the plant and equipment size scale-up continues to affect new design in all areas of power generation, transmission, and distribution. These qualitative aspects of the incremental capacity required add another dimension to the problems facing the Chinese electric power industry. Nevertheless, if all or most of the problems facing the electric power industry are solved, the industry probably could support an industrial growth rate of 10 percent for a sustained period commencing about 1981.

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Appendix 2. Power Transmission

Transmission lines in China are found at 66, 110, 154, and 220 kV, and at the one 330 kV circuit. Lines are generally carried on steel or reinforced concrete towers or poles. For example, the 173 mile long, 220 kV Maoming-Chiangmen line, completed in 1975, is carried on 177 steel and 597 concrete pylons; the tallest steel pylon is 184 feet, the shortest is 79 feet. Distribution lines are 6, 11, and 35 kV carried primarily on concrete poles in woodshy China. Domestic consumption is at 380 and 220 volt, 50 hertz.

Experimental work is being carried out in China on 500 kV transmission systems. The Shenyang transformer works is doing practice repairs on a 500 kV test line. There is no direct evidence of test work on high voltage direct current (HVDC) transmission, but it is known that the Chinese have a strong interest in this area. A move to HVDC may be necessary if the PRC is to efficiently move large blocks of power from major hydro facilities on the upper reaches of the Yangtze and Yellow Rivers to distant industrial centers.

The Chinese have done considerable work in live-wire maintenance of transmission lines, including the transformation of lines to higher voltages without interruption. The Fushin-Chinchou line in Liaoning had its capacity doubled in 1973 without interruption in the power supply.

A notable Chinese achievement is the 220 kV Yangtze River transmission line crossing at Nanking. The south channel crossing is on towers 635 feet high spanning 6340 feet, the longest span and tallest transmission towers in China. The towers are constructed of steel tubing with prestressed cross arms. Transmission cable is composed of 19 high-strength steel wires and 38 aluminum-covered steel wires. Construction of the crossing, which connects the Nanking thermal station north of the river with the city to the south, was begun in May 1974 and completed in September 1976.

Appendix 3. Power Capacity and Generation (1976–1977)

In 1976, the Chinese published information about turbo-generator units totalling about 2000 MW of capacity, including the following units that were installed; 300 MW-Wangting; 200 MW-Hsinten, Chaoyang, and two at Huantai; 125 MW-Huainan, Hsintushan, and Laiwu; 100 MW-Wulashan and Hsinhua; 75 MW-Ansha, Pikou, and Kungtsui; and several others that are less certain. This does not include the contribution to capacity made by new units at thermal and hydro plants in the 1 to 29 MW range nor does it include the capacity from approximately 5000 small hydros added (at an average of 50 kW per hydro, this would yield an additional 250 MW of capacity). There is also probably some unknown residual that was not announced.

It is not clear what damage the political turmoil did to the construction effort in the power industry in 1976. Certainly the July earthquake impacted heavily on the construction of the new 750 MW Japanese-supplied power plant in Tangshan and possibly on the 640 MW Italian-supplied thermal station at Tientsin. No information is available on whether the French and Swiss-supplied, 300 MW coal-fired station became operable in 1976 as originally scheduled. The assumption is that none of these foreign-supplied plants contributed to capacity in 1976. But given the four 200 MW units imported from the Soviet Union in 1975 and 1976 and the possible addition of another Chinese-built 300 MW unit, it seems reasonable to postulate that around 2900 MW of turbo-generating capacity were added in 1976. This represents a growth in capacity of about 8.5 percent.

For 1977, about 1950 MW of additional capacity was announced, including the following units: 300 MW-Wangting; 200 MW-Hsintien and Chaoyang; 125 MW-Taoho (2), Huaipei, and Huainan; 100 MW-Matou (3) and Chingshan; 75 MW-Pikou and Kungtsui; 50 MW-Panshan, Tienchiao, and Yungan; 30 MW-Mashek; and several others that are less certain. The same situation as in 1976 applies to the medium sized plant additions, the Soviet generators, possibly an unannounced 300 M6 unit, and to the estimated 5000 small hydros added.

In mid-year pledges, the Peking Electricity Administration undertook to add 800 MW of generating capacity in 1977 and the Shensi and Shantung power authorities to add 500 MW of capacity. At the end of the year, it was announced that 465 MW of a planned 765 MW became operative in the Peking-Tientsin-Tangshan triangle, including two units at the Taoho station in Tangshan. Of the 500 MW, 250 represents new units, not otherwise announced.

It is also known that a total of forty large and medium size units became operational in 1977 leading to Peking's New Year's Day statement that a "considerably greater generating capacity than those built in 1976 were put into operation." No allowance is made for the Italian or French/Swiss-supplied thermal stations whose construction has likely been delayed. This suggests the addition of 3600 MW and a growth in generating capacity in 1977 of about 9.8 percent over 1976.

The power generated by the installed capacity in 1976 and 1977 is derived from estimates of the number of hours the mid-year capacity is operated annually. Ordinarily in the face of a power shortage, this figure would be expected to rise, however, if an above average share of capacity is already in base load service, as appears to be the case in the PRC, then this places a limit on how much more the capacity could be operated safely. The amount of planned maintenance and unexpected outages is another factor for which little information exists. In the face of no industrial growth, the rate might remain rather static. Political turmoil as occurred in 1976 might cause interruptions in power service although there is no information this actually took place as it did in other industries. Interruptions in the supply of coal, which did take place, could cause fossil-fueled thermal stations to curtail operations, however. Drought and irrigation requirements can impact rather heavily on hydroelectric operations and in China, with around 38 percent of all capacity in hydro units, this is a significant factor often causing reduced hours of operation. Natural disasters as at Tangshan also cause interruptions.

In 1977, there was a sharp rise in industrial output requiring more power and there was some improvement in worker morale and plant discipline contributing to more efficient operation. Little is known, however, of the industrial operations of heavy power consumers such as aluminum and nuclear weapons manufacture. The power shortage persisted and the question remains whether the generating capacity already heavily engaged in base load service could be much more extensively operated. Given these circumstances and in comparisons with operations in other developing and developed countries, it is believed that 3,500 hours of operation annually in 1976 and 3,525 hours in 1977 are reasonable (the extra 25 hours added to reflect increased efficiency). The 3,500 hour figure is a composite rate based on 2,000 hours for small hydros, 3,000 hours for large hydros and 4,000 hours for thermal stations. These yield power outputs of 124 billion kilowatt-hours in 1976 and 136 billion kilowatt-hours in 1977.

The reader should be impressed by the tenuous nature of these estimates.

Appendix 4. The Hydroelectric and Thermal Power Plants of 30 MW and Higher[41]

Anhwei

1. Chentsun HES 150 MW—A three unit hydro on the Chingi River in Chiu County started in 1958, restarted in 1968, and completed in 1975. Chentsun serves the East grid.
2. Foutzuling HES 31 MW—A small hydro on the Pi River near Hoshan.
3. Hofei 68 MW—A 50 MW turbo-generator went into operation here in 1972 to supplement two old and small units. Supplies power to the Anhwei-Kiangsu regional grid.
4. Hsianghungtien HES 40 MW—On the Pi River near Tushan.
5. Hsiangwangchengtzu 100 MW—Located in the north end of the province, two 50 MW turbo-generators were installed here in 1973.
6. Huainan 306 MW—Several stations in a power complex serving the Anhwei-Kiangsu grid. A 125 MW unit, the largest in Anhwei, went into operation in 1976 and another of the same on line in 1977 at this "mine-mouth station."
7. Huaipei 225 MW—The first phase of construction brought two 50 MW units into operation in 1973 at this "mine-mouth plant." The second phase saw a 125 MW unit installed in 1977 and another unit under construction. By the end of 1978 capacity should be 350 MW.
8. Linhuaikang 30–50 MW—Located in the suburbs of Hofei, the actual size of this station is uncertain.
9. Maanshan 48 MW—Has four 12 MW generators.
10. Maochienshan HES 30 MW—On the Wan River in Yuehsi Countu, Anching Prefecture.
11. Meishan HES 40 MW—On the Shih River in Luan Prefecture, Meishan has four 10 MW turbo-generators.

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[41] HES is hydroelectric station, otherwise facility is a thermal power plant. Capacities shown are those known or estimated as of December 31, 1977. Under construction (u.c.)

12. Ssuhoshan 50–75 MW—In the city of Wuhu serving the Anhwei-Kiangsu grid.

Chekiang

13. Chililung HES 420 MW—A low head hydro on the Fuchun River near Tonglu with six units at 50 MW and two at 60 MW.
14. Chakou 30–50 MW—Sometimes referred to as Hangchow Plant No. 1.
15. Fuchun HES 180 MW—A low head hydro on the Chientang River, a tributary of the Fuchun. Has three turbo-generators at 60 MW each.
16. Hsinan HES 652.5 MW—A main station in the East grid located on the Hsinan River. Nine units at 72.5 MW a piece.
17. Huangtankou HES 30 MW—A small, 4-unit hydro on the Wuchi River.
18. Meichi HES 60 MW—South of Tai Lake. A fifth 12 MW unit became operative in 1975.
19. Panshan 100 MW—A second 50 MW generator went into operation here in late 1977. It is assumed that there are two at this, the second power plant in Hangchow.

Fukien

20. Ansha HES 115 MW—On the Chiulung River in Sanming Prefecture. Has three units, two at 20 MW and one at 75 MW.
21. Kutien HES 158 MW—A cascade system of four dams with a fifth planned. Kutien No. 1 has six generators totaling 62 MW while Kutien No. 2 and No. 4 are believed to have a generating capacity of 32 MW each.
22. Putien HES 30 MW—Hydro is probably larger than 30 MW serving Foochow via new 220 kV line.
23. Sanming 35–50 MW—Provides power to a 220 kV transmission system.
24. Yungan 50 MW—The first stage expansion completed in 1975 saw the addition of two units of 25 MW each. The second stage, being rushed to completion at the end of 1977, will add two units at 50 MW apiece making Yungan the largest thermal station in Fukien at more than 150 MW.

Heilungkiang

25. Chiamussu 100 MW—Serves nearby coal mines and the city of Chiamussu. The 100 MW unit is undergoing improvements.
26. Chihsi 87 MW—Probably has three units at 50, 25, and 12 MW.
27. Chingpo HES 36 MW—A small hydro on the Mutan River in Ningan County being expanded to 144 MW by the addition of three 36 MW units.
28. Fulaerhchi 125 MW—Modifications in 1976 to permit highest boiler operating temperatures in China allowed a 23 percent boost in generating capacity.
29. Harbin 73 MW—One of two power plants in Harbin.
30. Harbin Heat and Power 200 MW—Has two generating units of 100 MW each. The second became operational in 1976.
31. Hsinhua 150 MW—A new facility with a 100 MW turbo-generator becoming operative by 1976. A 50 MW unit went into operation in 1973. Location uncertain.
32. Peian 36 MW—A 12 MW generator installed here in 1977 assumed to be the third.
33. Taching No. 1 35–50 MW—An old power station at Anta now assumed to be Taching No. 1.
34. Taching No. 2 100 MW—A new station to supply expanded refining and petrochemical operations. Two units became operative in 1973.

Honan

35. Anyang 50–100 MW—Started during the Cultural Revolution.
36. Chengchou 100 MW—In the city of Chengchou.
37. Hsinhsiang 42.5 MW—In Hsinhsiang city. Has small units with the largest 25 MW. May have been expanded.
38. Loyang 175 MW—Was expanded from 75 MW in 1958 to 175 MW currently.
39. Pingtingshan 250 MW—Probably a two plant complex. Originally 30 MW expanded to 250 MW with further increases in capacity likely.
40. Sanmen HES 100–150 MW—Originally a Soviet aid project later completed by the Chinese, but because of silt problems in the Yellow River, total generating capacity will be limited to 200 to 250 MW.
41. Tangho 200 MW—The largest single plant in Honan. The second of two 100 MW units became operational in April 1975. Located in Nanyang Prefecture.

Hopeh

42. Hantan 86 MW—Probably has six 12 MW units, but improvements have increased capacity by 20 percent.
43. Hsiamaling HES 65 MW—On the Yungting River near Peking.
44. Kuanting HES 30 MW—On the Yungting River near Peking.
45. Luanho 96 MW—In Chengte City.
46. Luanho HES u.c.—A large hydro under construction just west of Chengte city. No generators will come on line here brfore 1979.
47. Matou 200 MW—A new plant with two 100 MW units added in 1977. Connected to the south Hopei grid.
48. Paoting 50 MW—Completed in 1958.
49. Pingshan HES 40 MW—On the Huto River northwest of Shihchiachuang.
50. Shihchiachuang 150 MW—Revamping of existing units between 1969 and 1973 increased capacity by 30 percent.
51. Tangshan 275 MW—In Tangshan city. All 10 generating units damaged in 1976 earthquake, but now back in operation. Supplies the North power grid.
52. Taoho 250 MW—In the northern suburbs of Tangshan. Site of the Hitachi (Japan) supplied plant of two 125 MW and two 250 MW units. Damaged in quake, but one 125 MW and one 250 MW unit back into operation in 1977. Workers pledged to have all generators operative by end of 1977, but this appears to have slipped until May 1978.
53. Weishui 30–50 MW—Constructed in 1954 with original planned capacity of 30 MW.

Hunan

54. Chechi HES 217.5 MW—On the Tzushui River near Anhua. Plans call for expansion to 435 MW.
55. Chuchou 60 MW—Into operation 1975. Expanded 1972.
56. Fengtu HES 30–40 MW—In Yunghsin County.
57. Hsiangtan 30 MW—Original plant has probably been expanded.
58. Hsintushan 125 MW—A new plant with a 125 MW turbo-generator, the largest in Hunan. Located in Shaoyang Prefecture.
59. Shuifumiao HES 36 MW—On the Lienshui River west of Hsianghsiang.
60. Tungchiang HES u.c.—Started in 1958. Construction on this 157 m. high dam recommenced in 1978. Probable capacity 250–350 MW.
61. Yuehyang 30 MW—An old small power plant that has probably been expanded.

Hupeh

62. Huanglungtan HES 150 MW—On the Tu River, a tributary of the Han. Construction started 1969 and plant became operational in 1974.
63. Huangshih 128 MW—In Huangshih city southeast of Wuhan.
64. Tanchiangkou HES 900 MW—China's second largest hydro and power station. Has six 150 MW generators.
65. Wuhan 450 MW—The Chingshan station under expansion. Two 100 MW units added in 1977.
66. Wuhan 100 MW—Wuhan No. 3 station in the Hankow section.

Inner Mongolia

67. Huhohaote 50 MW—Probably has two 25 MW generators.
68. Paotou No. 1 100 MW—Expansion planned to 200 MW.
69. Paotou No. 2 100 MW—In Paotou City.
70. Urat Mountain 100 MW—At Wulashan, location unknown. A new 100 MW unit became operational in early 1976.

Kansu

71. Lanchou 300 MW—The Hsiku station originally planned for 525 MW.
72. Liuchia HES 1,225 MW—China's largest power plant located on the Yellow River west of Lanchou. Has five turbo-generators including China's first 300 MW hydraulic unit.
73. Papan HES 180 MW—Another Yellow River hydro. With five units probably at 36 MW each. Construction started 1959, fully operational 1975.
74. Pikou HES 217.5 MW—A new station on the Pailung River in southern Kansu, with three 72.5 MW units, the last becoming operational in 1977. The dam is the largest rock and earth filled dam in the PRC.

75. Yenkuo HES 300 MW—On the Yellow River 40 miles from Lanchou. Probably has six 50 MW turbo-generators.
76. Yumen 150 MW—Plans call for 300 MW when complete.
77. Yumen Heat and Power 36 MW—Another thermal station located in Yumen.
78. Yungchang 36 MW—Located in Yungchang City.

Kiangsi

79. Chiangkou HES 75 MW—Near Hsinyu on the Yuanshui River. Probably has 25 MW units.
80. Feni 30 MW—Capacity uncertain, but during 1978 two 50 MW turbo-generators were being installed at Feni.
81. Lowan HES u.c.—Construction started 1970 on this the first high head hydro in Kiangsi. No power as of 1977.
82. Nanchang 51 MW—The Chilichieh station in Nanchang.
83. Shangyu HES 60 MW—The first hydro station designed by the PRC. Located on the Chang River. Has four 15 MW units.
84. Talin HES 100 MW—Believed to be on the Hsiushui River in the vicinity of Tean about 45 miles north of Nanchang. Planned capacity possibly 400 MW.

Kiangsu

85. Chienpi 224 MW—Located in Chenchiang. Probably has four 50 MW and one 24 MW units.
86. Hsuchow u.c.—A new 125 MW turbo-generator installed in this new thermal station in January 1978.
87. Huaiyin 50 MW—A new 25 MW generator became operational in 1972.
88. Nanking 100–150 MW—The Hsiakuan station in Nanking.
89. Nanking 100 MW—The Tachangchen power plant in Nanking.
90. Tienshengkang 50 MW—In Nantung on the north bank of the Yangtze River. Capacity was doubled in 1971 with the addition of a 25 MW unit.
91. Wangting 713 MW—Currently thought to be China's largest thermal station with two 300 MW units and some old Czech and Hungarian generators.

Kirin

92. Changchun 50 MW—Located at China's largest truck plant. There is probably another power station in or near Changchun.
93. Erhtaochiang 55 MW—Located in Tunghua County.
94. Hulato Unbong HES 300 MW—On the Yalu River. Power distribution is split with North Korea.
95. Kirin 400 MW—Most of the generating units here are 50 MW.
96. Liaoyuan 30–40 MW—Small thermal plant that overfulfilled plan in July :977.
97. Tafengman HES 590 MW—A primary station in the Northeast net located on the Sungari River 15 miles from Kirin. Has eight units.

Kwangsi

98. Homienshih HES 68 MW—On the Ho River in Wuchou Prefecture. Four generating units. Started 1958, restarted 1970, completed 1976.
99. Hsiching HES 217.5 MW—On the Yu River in Nanning Prefecture. Three units at 72.5 MW, the last installed in 1967.
100. Kweilin 30 MW—A small thermal station in Kwelin. Size uncertain.
101. Luichou 36 MW—Started 1958, completed 1962.
102. Mashek HES 100 MW—Has three units totaling 100 MW. Construction began 1970, station fully operative 1977. On the Yung River.

Kwangtung

103. Changhu HES 72 MW—Located five miles southeast of Yingte. Has two 36 MW generators. Construction started 1970, completed 1974.
104. Chiaoling HES 60 MW—In Meihsien Prefecture on a tributary of the Han River.
105. Fengshapa HES 225 MW—Has three 75 MW hydro units, the first two installed in 1973.
106. Hsinfengho HES 290 MW—Largest station in Kwangtung, near Hoyuan. Probably has four 72.5 MW turbo-generators.
107. Huangpu u.c.—A new thermal station in Kwangchow to be the largest in the province. The first generator will likely be 125 MW and there will probably be three units.

108. Kwangchow 105 MW—The Hsitsun plant with eight generators.
109. Liuchi HES 42 MW—Four 10.5 MW Francis units. On the Liuchi River near Liangkou.
110. Maoming 200 MW—Currently the largest thermal plant in Kwangtung.
111. Nanshui HES 50 MW—Located on a tributary of the Pei River near Juyuan. Has two 25 MW generators.
112. Tanling HES 30-50 MW—Located on the Lien River in Lien County, Shaokuan Prefecture.
113. Wushih 193 MW—In Shaokuan Prefecture. A new generator which became operational in 1972 boosted capacity by 40 percent.

Kweichow

114. Chingchen 64 MW—Located in suburbs of Chingchen. Has four 32 MW Hungarian turbo-generators. Expansion by the addition of two 75 MW units planned.
115. Kweiyang 124 MW—Became operational in 1958.
116. Maotiao HES 250 MW—A six level cascade system in Chingchen County with generators operational or planned for five stages. Includes the Hungfeng HES at 20 MW. Not clear whether planned capacity of 250–300 MW has been reached.
117. Suicheng HES 30 MW—Recently referred to as "one of many crucial power plants."
118. Tsuni 30–50 MW—Original plans call for expansion to 200 MW.
119. Wuchiangtu HES u.c.—Planned capacity unclear, but possibly 200 MW.

Liaoning

120. Anshan 55.5 MW—Part of the Anshan Steel Works. Plans call for expansion to 200 MW.
121. Chaoyang 400 MW—A new plant in west Liaoning. New 200 MW generators installed in 1976 and 1977 with a third due soon raising station capacity to 600 MW.
122. Chingho u.c.—Location of this new "key" project uncertain. Size uncertain, but to be part of the Northeast grid.
123. Fuhsin 236 MW—A major unit in the Northeast grid. Probably larger than 326 MW but details lacking.
124. Fushun 345 MW—The Taikantan station. Another major component of the Northeast grid. Size may be larger than indicated.
125. Fushun 100 MW—Part of the No. 2 shale oil plant complex.
126. Fushun HES 32 MW—The Tahuofeng hydro on the Hun River.
127. Huanjen HES 290 MW—On the Hun River. A two station hydro with two 72. 5 MW units in each station. Stations became operative in 1968. In the Northeast grid.
128. Liaoning 600 MW—The largest thermal station in the Northeast located between Fushun and Shenyang.
129. Luta No. 1 52 MW—Located in Dairen (Luta). Known as the Amanogawa station.
130. Luta No. 2 98 MW—The Kanchingtzu station in Dairen (Luta).
131. Penchi 86 MW—Part of the Penchi Steel Plant.
132. Shenwo HES u.c.—Uncertain whether this station on Taitzu River near Liaoyong is yet operative. Based on plans to produce 100 million kilowatt-hours, plant is probably about 40 MW.
133. Shenyang 50 MW—The Tiehsi station in Shenyang. Planned expansion calls for a total capacity of 200 MW.
134. Supong Dong Sui HES 700 MW—On the Yalu River. Power is shared with North Korea.
135. Swiss/French u.c.—The location and name for this Swiss/French-supplied brown coal-fired, 300 MW thermal station is unknown.

Ningsia

136. Chingtung HES 225 MW—First generator of 37.5 MW operational in 1967. The sixth operational in 1975. A seventh unit will bring capacity to 262.5 MW.
137. Shihtsuishan HES u.c.—Another hydro on the Yellow River, planned capacity unknown, but probably several hundred megawatts.

Peking

138. Chinghsi 200 MW—A new plant and one of the three stations comprising the Shihchingshan complex. The first 200 MW unit became operational in 1975.
139. Kaoching 600 MW—The largest station in the Shihchingshan complex. Has six 100 MW turbo-generators, the last installed in 1974.
140. Miyun HES 93 MW—North of Peking. Has a 90 and a 3 MW generator. Reportedly has an 11 MW pumped storage unit, possibly the only such unit in China.
141. Peking No. 1 300 MW—In Peking's eastern suburbs. Has two 25 MW, one 50 MW, and two 100 MW units, the last 100 MW unit installed in 1967.
142. Peking No. 2—A new thermal station, possibly known as Chuwo, under construction. Planned capacity unknown. First unit, possibly 200 MW, into operation 1978.
143. Shihchingshan 100 MW—The original station in the three station complex. Uses low grade coal.

Shanghai

144. Chapei 274 MW—An early plant expanded by the addition of a 50 MW unit in 1973 and a 100 MW generator in 1974.
145. Minhang 300 MW—A new 125 MW generator added in 1973.
146. Nanshih 100 MW—A 50 MW unit became operational in 1972.
147. Wuching 355 MW—A major unit in the East grid. Has six units of 125, 100, 50, and 25 MW capacity.
148. Yangshupa 227 MW—An old pre-Revolution station with at least six units.

Shansi

149. Huohsien 125 MW—A 100 MW unit became operational in 1973 permitting linkage of the north and south Shansi grids.
150. Liangtzukuan 100 MW—In the Taihang Mountains east of Yangchuan. The 100 MW unit became operational in 1972.
151. Shuohsien 30 MW—Located in north Shansi. Size uncertain.
152. Taiyuan No. 1 50 MW—One of three power plants in this steel town.
153. Taiyuan No. 2 250 MW—Is believed to have six units, four at 50 MW and two at 25 MW.
154. Taiyuan Steel 72 MW—Part of the Taiyuan Steel Plant.
155. Tatung 54 MW—The Pingwang station in this important coal center. May be another power plant here.

Shantung

156. Chining 50 MW—On the Grand Canal in southern Shantung.
157. Hanchuang 52 MW—Located in Hanchuang City. Plans call for expansion to 202 MW.
158. Hsintai 36 MW—In Hsintai City.
159. Hsintien 600 MW—A new thermal station near the Shengli oil field. Has two 100 MW units and two 200 MW generators, the last becoming operational in early 1977.
160. Huangtai 475 MW—In Tsinan. In 1976 two 200 MW units were added.
161. Laiwu 375 MW—Another new Shantung station begun in 1970. Has three 125 MW units, the last becoming operational in 1976.
162. Ssufang 45 MW—Located in Tsingtao. This station has probably been expanded.
163. Tzupo 50–100 MW—The Nanting station in Tzupo. There may be a second thermal plant here.
164. Yentai 30–50 MW—Size of this plant which overfulfilled the plan in 1975 is uncertain.

Shensi

165. Chinling 250 MW—Location of this new plant with two 125 MW turbo-generators is uncertain.
166. Paochi 50 MW—Located in the city of Paochi.
167. Shihchuan HES 135 MW—On the Han River. Has three units.
168. Sian No. 2 54 MW—The Pachiao station.
169. Sian No. 3 250 MW—The Huhsien station.
170. Tienchiao HES 50 MW—A new station in the middle reaches of the Yellow River serving northern Shansi and Shensi. Size unknown, but when completed likely to total around 300 MW.

Sinkiang

171. Kuerhlo HES 50–100 MW—On the Kungchiao River near Kuerhlo.
172. Weihuliang 73 MW—In Wulumuchi (Urumchi)

Szechwan

173. Chengtu 250 MW—Completed in 1959.
174. Chungching 112 MW—Thermal station No. 507.
175. Hsiaoshihtzu HES 90 MW—On the Tatu River near Loshan.
176. Kungtsui HES 507.5 MW—On the Tatu River in Lushan County. Basically completed in 1977, this facility has seven 72.5 MW units.
177. Lungchi HES 108 MW—A cascade system on the Lungchi River near Changshou. System includes Shihtzutan HES at 48 MW, Shangtung HES at 11 MW, Hilungchai HES at 16 MW, and Hsiatang HES at 33 MW.
178. Mofangkou HES 37.5 MW—On the Chengtu-Kunming Railway south of Mienning.
179. Paimamiao 50 MW—A thermal station at Neichiang.

Tibet

180. Chinho HES 50 MW—Believed to have four 12.5 MW generators but may be smaller. Near Changtu.
181. Ngachen HES 30 MW—This station at Lhasa has four generators believed to be 7.5 MW each.

Tientsin

182. Tientsin No. 1 150 MW—Built in the 1950's.
183. Tientsin No. 2 over 100 MW—Located in the eastern suburbs at Chinliangchen. Has gas turbines in a combined cycle with steam units.
184. Tientsin u.c.—The plant being supplied by GIE-Ansaldo of Italy. Will have two 320 MW generators for a total station capacity of 640 MW.

Tsinghai

185. Chaoyang HES 30 MW—Supplies power to a 220 kV transmission line. Located in the vicinity of Hsining.
186. Lungyen HES u.c.—A major new project with planned output likely in excess of 1,000 MW. Believed located near Kweite on the Yellow River.

Yunnan

187. Hsuanwei 50–100 MW—Original plans call for expansion to 600 MW. Supplies power to Kunming.
188. Ili HES 172 MW—A cascade system on the Ili River having four dams including Tungchuan 10 MW, Shuitsaotzu 18 MW, and Yenshuikuo 144 MW. The fourth dam may not be operational, but was originally planned to have a 230 MW capacity.
189. Kaiyuan 64 MW—Has two generators at 48 and 16 MW.
190. Kunming over 30 MW—The Pupingtsun station at Kunming.
191. Kunming 60 MW—The Yangtsunghai station with five units at 12 MW each.
192. Luhsi u.c.—A new plant under construction about 60 miles from Luhsi. Capacity to be installed believed to be over 50 MW.

Appendix 5. Typical Thermal Power Station

Kaoching, 30 km west of the center of Peking and the largest of the three thermal stations comprising the Shihchingshan power complex, appears typical of China's larger fossil-fueled plants. Construction commenced in 1959 and was completed in 1974 with start-up of the sixth and last generator. Kaoching serves Peking via 110 and 220 kV transmission lines and reportedly is not tied into the North power grid.

The six hydrogen-cooled, 100 MW turbo-generator sets at the station were installed in 1961, 1963, 1967, 1970, 1973, and 1974; Nos. 1, 2, and 5 are Soviet-built, the balance being Chinese. There are four Soviet 220 ton/hr boilers for units 1 and 2 while the four boilers for units 3–6 producing steam at 410–430 tons/hr are Chinese-manufactured. Boilers are natural circulation at 100 kg/cm^2 and

510° C with no reheat. The pulverized coal fired at Kaoching comes from Tatung in Shansi and has the following characteristics: 6,500 kcal/kg heating value; volatiles, 25 percent; ash, 13–15 percent; and sulfur, 1.5–1.7 percent.

The control room at Kaoching for units 3, 4, and 5 has an alarm scanner monitoring 130 points per minute with about 40 parameters recorded automatically in an hourly log. In 1974 this scan and log system was said to be "on-trial." It is similar to equipment found in the U.S. about 1960. The newest control room (for unit 6) has a controller capable of adjusting 30 operating parameters and of starting up or shutting down various pieces of equipment. This Chinese control system is said to have taken three years to develop.

APPENDIX 6. ELECTRIC POWER EQUIPMENT MANUFACTURING PLANTS

Plant and Location	*Equipment Produced*
Steam Boilers:	
Harbin Boiler Plant	One of the PRC's two main boiler manufacturing plants; with a capacity to produce boilers for 200 and 300 MW turbines. Since 1970 has produced boilers to 670 mt/h, 140 kg/cm^2, and 570/570°C for 200 MW turbines but is now developing boilers for 600 MW turbines. Has program-controlled bending lines.
Shanghai Boiler Plant	The other chief boiler plant; started with Czech assistance. Boilers are produced to match turbines in the 25 to 125 MW class and possibly to 300 MW.
Peking Boiler Plant	A major facility but less important than Harbin and Shanghai. Works in concert with the two turbine producers in Peking.
Other Boiler Plants	Approximately a dozen plants in Wuhan, Hangchow and elsewhere produce power boilers, mostly drum types in smaller sizes; these plants produce industrial boilers as well. In addition a number of heavy machine building plants manufacturing pressure vessels could produce power boilers.
Turbines and Generators:	
Harbin Turbine Plant	Manufactures steam turbines in the 12.5/25/50/100/125/200 MW class. Also produces 72.5 MW, 225 MW and the first Chinese 300 MW hydro-turbine. Currently has 600 MW turbines under development.
Harbin Electrical Machinery Plant	Produces generators to complement the turbines produced at the Harbin Turbine Plant. Manufactured the 225 MW rated generators for the Liuchia Dam.
Shenyang Blower Plant	Steam turbines up to 50 MW manufactured here under Siemens (West Germany) license will be used to drive compressors, also built here.
Shanghai Turbine Plant	A lead turbine plant serially manufacturing steam turbines in the 25 to 300 MW class. Has apparently produced 6 MW and possibly 10 MW gas turbines.
Shanghai Electrical Machinery Plant	Generators up to 300 MW manufactured here complement turbines produced at the Shanghai Turbine Plant.
Peking Heavy Electrical Machinery Plant.	Produced steam turbo-generator sets up to 100 MW.
Peking Steam Turbine and Generator Plant	Does developmental work with Tsinghua University and manufactures some turbines for the Peking Heavy Electrical Machinery Plant.
Tientsin Electrical Machinery Plant	The production of 80 MW turbo-generators planned for 1976.

APPENDIX 6. ELECTRIC POWER EQUIPMENT MANUFACTURING PLANTS—Continued

Plant and Location	*Equipment Produced*
Turbines and Generators—Con.	
Tungfang Electrical Machinery Plant, Teyang, Szechwan	A new facility reachingful 1 capacity in 974 Produces 150 MW hydrogenerators and 200 MW steam turbo-generators. Supplied the turbines and generators for the Tanchiangkou Dam. May produce boilers.
Other Turbine and Generator Plants	Turbines and generators in the size range 1 MW to 50 MW are produced at some 15–20 smaller manufacturing plants, including Wuhan, Nanchang, Nanping, and Chungching. 100 MW steam turbine plant under construction in Hangchow, to start in 1978.
Power Transformers:	
Shenyang Transformer Plant	The most important transformer producing plant in the PRC. Manufactures a series of 50 transformers in 650 variations, the largest being 260 MVA.
Sian Transformer Plant.	China's first 330 MVA power transformer built here.
Paoting Transformer Plant.	Has manufactured 100 MVA transformers.
Other Transformer Plants.	Other facilities at Shanghai, Changchow, Lanchow and elsewhere manufacture distribution and other smaller transformers.
Switchgear Plants:	
Shenyang Switchgear Plant.	A large manufacture of power circuit breakers and other switchgear.
Sian Switchgear Plant	Manufactures large circuit breakers for power stations.
Shanghai Switchgear Plant.	Manufactures oil circuit breakers to 220 kV, 1000 A, 7000 MVA. Also produces sodium hexafluoride insulated 35 kV, 400 MVA circuit breakers. A high voltage laboratory contains a 2.4 million-volt impulse transformer capable of delivering one million volts. Some switchgear products are exported.
Wire and Cable Plants:	
Shenyang Wire and Cable Plant.	China's major cable manufacture. Has produced aluminum and copper wire and cables. Has produced 220/330 kV power cable and researches cable.
Shanghai Wire and Cable Plant.	Manufactures 220 kV oil-filled conductors and paper insulated power cable to 300 kV.
Other Wire and Cable Plants.	Smaller plants in Tientsin, Chengchow, Chungching, Kunming, Hsiangtan, and elsewhere produce wire and cable for power applications.
Other Power Equipment Plants.	The many other components needed by the electric power industry are widely produced in China, especially in the smaller sizes for the countryside.

Part III. POPULATION AND LABOR UTILIZATION

POPULATION GROWTH IN THE PEOPLE'S REPUBLIC OF CHINA

By John S. Aird

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Most estimates of China's population prepared by foreign scholars during the early to middle 1970's were strongly influenced by the reported success of the current birth control and health campaigns and by the often repeated population total of 800 million. They showed sharply declining birth, death, and natural increase rates and in some cases abandoned the 1953 census and the yearend 1957 registration figures in favor of a much lower base total presumed to be the result of the 1964 investigation. By implication these estimates accepted the Chinese goal of an accelerated demographic transition as an accomplished fact.

In the spring of 1976, the Foreign Demographic Analysis Division (FDAD), Bureau of the Census, prepared three sets of estimates and projections for the People's Republic of China (PRC) which, while still based on the 1953 census population total, showed relatively slow and irregular declines in intrinsic fertility and mortality until the

1970's, followed by rapid declines in fertility into the 1980's and steady declines in mortality to the end of the century. The intermediate model reached a total of just over 950 million as of midyear 1976, and the low and high models ranged from about 900 million to 1 billion. These three estimates were the highest of all those prepared outside of China during the middle 1970's.

Since 1976 two things have happened that have changed the general perception of demographic levels and trends in the PRC. Following the death of Mao in August 1976 and the accession to power of Hua Kuo-feng in September, PRC sources charged that Hua's rivals in the successional struggle, now called the "gang of four," had opposed birth control and late marriage and had dealt serious setbacks to family planning and public health efforts for several years prior to their defeat. Beginning in September 1976 and continuing to the present, new provincial population figures have been appearing in news dispatches from the PRC that are larger than previously available figures; the new figures currently add to just under 920 million.

Unless one is prepared to argue that the setbacks blamed on the "gang" are political fictions without any substantive basis, population estimates for China cannot continue to show uninterrupted progress in the reduction of fertility and mortality throughout the middle 1970's. Unless one is also prepared to argue that PRC provincial data exaggerate the size of the population, the 1976 FDAD low series and all other estimates that do not substantially exceed a national total of 900 million by midyear 1976 are too low.

The purpose of this chapter is to assess the significance of the current demographic developments in the PRC in the perspective of China's demographic history and to present the assumptions, methods, and results of a new set of population estimates and projections.

RECENT TRENDS IN FAMILY PLANNING

Policy and Commitment

Almost 30 years have elapsed since Mao Tse-tung declared that China's large population was "a good thing" and that it could multiply "many times" without posing any difficulties for national development.[1] Now birth control has been written into the constitution of the PRC, and Hua Kuo-feng has called for a reduction of the national population growth rate to less than 1 percent within 3 years.[2]

The change did not come overnight. In the intervening years, Mao and his colleagues twice launched a birth control campaign and let it subside before coming to what appears to be an irrevocable commitment in the current birth control campaign.[3] The first signs of a renewal of birth control efforts after the cultural revolution appeared in 1968, but the drive did not really gather momentum until 1972 or 1973.

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[1] "The Bankruptcy of the Idealist Conception of History," September 19, 1949; *Selected Works of Mao Tse-tung*, vol. IV, Peking, Foreign Languages Press, 1961, pp. 453–454.

[2] "The Constitution of the People's Republic of China," adopted on Mar. 5, 1978, by the Fifth National People's Congress of the PRC, first session, New China News Agency (NCNA), Peking, Mar. 7, 1978; Foreign Broadcast Information Service (FBIS), No. 52 (Supplement), Mar. 16, 1978, p. 69; Hua Kuo-feng, "Unite and Strive to Build a Modern, Powerful Socialist Country," NCNA, Peking, Mar. 6, 1978; FBIS, No. 52 (supplement), Mar. 16, 1978, p. 27. Article 53 of the Constitution merely says that "the state advocates and encourages family planning."

[3] For an analysis of the vicissitudes of the first two birth control campaigns, see John S. Aird, "Population Policy and Demographic Prospects in the People's Republic of China," in Joint Economic Committee, Congress of the United States, *People's Republic of China; An Economic Assessment*, Washington, U.S. Government Printing Office, May 18, 1972, pp. 220–311.

Since 1973, however, the official endorsement of birth control has been more open and more forceful than at any time since the first campaign got under way in 1954. Lest anyone suppose that the new commitment might waver, like others taken in the past, authoritative spokesmen now insist that planned population growth is "an established policy of the Chinese government," [4] the purpose of which is to insure that population growth "corresponds to the development of the socialist planned economy." [5] Both domestic and foreign propaganda endorse the principle that "anarchy" in human reproduction is intolerable and that "man should control himself as well as nature." [6] Birth control is now identified with the leadership of the Chinese Communist Party to a greater degree than ever before. It is "an essential task which Chairman Mao personally advocated for many years." [7] The goal of a 1 percent growth rate is said to have been "the long cherished behest of esteemed and beloved Premier Chou." [8] Hua Kuo-feng reportedly "acted as a leader of the birth control leadership group of the State Council," "personally worked out the annual plans for birth control work," attended report meetings, listened and made notes,[9] and provided theoretical guidance for the work.[10] It is also disclosed, somewhat belatedly, that Hua gave an address at the National Conference on Family Planning and Birth Control Work in September 1974 in which he pointed out that birth control is "closely related" to the health and prosperity of the people and to the "speed of development of socialist revolution and socialist construction." [11] Recent dispatches from the PRC include local pledges to observe the "instructions" about birth control given by Mao, Chou En-lai, and Hua. What those instructions were is not disclosed, but the statements are obviously intended to convey the idea that the policy bears the personal endorsement of China's most respected leaders. Perhaps equally important, opposition to the policy is identified with Liu Shao-ch'i, Lin Piao, the "gang of four," and various unnamed "class enemies," [12] so that those who dare to resist may understand the political risks.

Once again, as in the first two birth control campaigns, the priority attached to birth control efforts seems to be related to official concern about the pace of economic development in general and of agricultural development in particular. Chinese officials have stated that the PRC made no significant economic advancement in the 10 years prior to the overthrow of the "gang of four" in the fall of 1976.[13] In May 1977, Yeh Chien-ying, vice chairman of the Central Committee of the Chinese Communist Party reminded the National Conference on Learning from Taching in Industry that agriculture was the "foundation of the national economy" and that "in a big country such as ours, only when agriculture is run well can the problem of feeding our 800 million people be solved and economic development be feasible." [14] A cold winter was followed by drought in the spring and early summer of 1977 and some flooding later in the summer. There were substantial purchases of foreign wheat during 1977, and Chinese reports of agricultural production at the end of the year were unusually vague and devoid of numbers, normally a sign that the news is not good. Early indications are that Chinese imports of wheat could be heavy again this year, perhaps exceeding the record import of 7.6 million metric tons in 1974.[15] The marked intensification of the birth control campaign since August surely signifies that the central authorities see control of population growth as more urgent than ever.

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[4] NCNA (English), Peking, August 23, 1974; FBIS No. 166, Aug. 26, 1974, p. E3. The phrase has since been repeated in domestic birth control propaganda.

[5] NCNA (English), Peking, Mar. 5, 1953; British Broadcasting Corporation, *Summary of World Broadcasts* (*SWB*), Mar. 14, 1973, FE/W715/A/1.

[6] "17th Session of U.N. Population Commission Concludes in Geneva," NCNA (English), Geneva, Nov. 9, 1973; American Consulate General, Hong Kong, *Current Background* (*CB*), No. 74-14, July 8, 1974, p. 64.

[7] Wuhan radio, Hupeh Provincial Service, Dec. 20, 1977; FBIS, No. 246, Dec. 22, 1977, p. H2.

[8] Nanking radio, Kiangsu Provincial Service, Apr. 10, 1978: FBIS, No. 72, Apr. 13, 1978, p. G5.

[9] Canton radio, Kwangtung Provincial Service, Dec. 12, 1976, FBIS, No. 242, Dec. 15, 1976, p. H16.

[10] Hangchow radio, Chekiang Provincial Service, Jan. 16, 1977: FBIS, No. 14, Jan. 21, 1977, p. G4.

[11] "Family Planning and Birth Control Work Considered To Be One of the Important Aspects of the Agriculture-Learning-From Ta-chai Movement," *Jen-min jih-pao* (JMJP), Peking, Mar. 2, 1977; *Joint Publications Research Service* (*JPRS*) No. 69,038, May 3, 1977, p. 18.

[12] *Ibid.*, p. 19.

[13] Harrison E. Salisbury, "China's Leaders View Last 10 Years as 'Lost,'" *New York Times*, Nov. 5, 1977, p. C3.

Campaign Tactics

Current promotional tactics also reflect the new resolve. Centrally determined planned population growth rates establish the overall objectives within which provincial growth rate targets are set, and these serve as the basis for the target rates for counties, which prescribe those for lower level units. At the lowest levels, a quota of births is allocated among the eligible married couples on a priority basis. The priorities seem to be related to age at marriage, the number of years married, whether or not the couple already has one child, and how long a time interval has elapsed since the birth of the first child. There are indications that the limit has now been set at two children per family. Several provinces have pledged that they will strive to get their population growth rates down to 8 per 1,000 by 1980 or 1985.[16] Other provinces, without disclosing their own target figures, have undertaken to develop their birth control work so that they can insure fulfillment of the "population plan" that is part of the fifth Five-Year Plan (1976–80).[17]

With the mounting pressures on local cadres to meet mandatory population growth targets handed down from above, there will be increasing temptation to resort to coercive measures when no other option is available. News dispatches that seem to refer to forms of coercion have been coming out of the PRC since the early 1970's. A Shantung commune reported using "mass criticism and repudiation" in order to "smash reactionary fallacies and shatter feudal concepts" relating to marriage and childbearing. [18] In another commune in the same area where there were 21 women in one production brigade "who should have controlled their childbearing but did not," the cadres "strengthened solidarity among them, eradicated their old fashioned notions * * *, and thus promoted a sense of planned parenthood among them." [19] Other dispatches proclaim the "violent struggle between the two classes,"[20] the "dictatorship of the proletariat,"[21] and the "needs of the revolution"[22] as the political watchwords for planned parenthood work.

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[14] Excerpts from his speech given by NCNA, Peking, May 12, 1977; FBIS, No. 93, May 13, 1977, p. E3.

[15] Gene Meyer, "China May Become No. 1 Importer Of Wheat This Year, Analysts Say," *Wall Street Journal*, Feb. 9, 1978, p. 30.

[16] Hupeh is to reach 8 per 1,000 by 1980 and Anhwei to get below 8 per 1,000 by 1985. See Wuhan, Hupeh Provincial Service, Dec. 20, 1977; *JPRS*, No. 70,533, Jan. 24, 1978, p. 87, and Hofei radio, Anhwei Provincial Service, Jan. 18, 1978; FBIS, No. 16, Jan. 24, 1978, p. G10.

[17] Foochow radio, Fukien Provincial Service, Jan. 24, 1978; FBIS, No. 18, Jan. 26, 1978, p. G4, and Canton radio, Kwangtung Provincial Service, Apr. 10, 1978; FBIS, No. 71, Apr. 12, 1978, p. H16.

[18] Birth Control Office, Wentung County, Shantung Province, "Penetratingly Develop Birth Control Work, Contribute More to the Revolution," *Ch'ih-chüeh i-sheng tsa-chih* (*Barefoot Doctor Journal*), No. 1, 1973.

[19] *Ibid.*

PRC news dispatches provide no direct evidence of coercion. When the subject is mentioned in news items, the official position that the program is entirely voluntary is reiterated. Items on population policy intended for foreign audiences insist that "birth control in China is on a voluntary basis under state guidance."[23] Items for domestic consumption insist that "arbitrary orders" may not be issued.[24] One item describes a local Party committee that was "at loggerheads" over the question of whether to rely on "meticulous ideological work" or to resort to "administrative orders." Some members wanted to "lay down a few hard and fast regulations, so that time could be saved and quick results produced." In this instance, reportedly, they were overruled,[25] but the decision probably does not always go that way, hence the need to make an example of this case. Accounts from refugees suggest that there are many places in which open coercion has been applied in a variety of forms, from organized peer group pressures and public denunciations to denial of maternity leave, refusal of birth registration, withholding of food and cloth rations, and even compulsory sterilization.[26] Where strong pressure for target fulfillment encounters continuing popular resistance, there may be increasing temptations for local cadres to resort to coercive measures to assure the compliance on which their careers depend. It is sometimes asserted both by Chinese and by foreign observers that mass coercion is a political impossibility in the PRC or anywhere else in the world, hence whatever success the Chinese are having in family planning must be due in major part to voluntary cooperation from the people. In fact, however, coercion has been used successfully during "land reform," cooperativization, and other mass movements in China, the Party maintaining all the while that it was using persuasion or education rather than force. Instances of coercion that brought strong popular reactions were usually attributed to the failure of local cadres to understand and apply central policies correctly and were denounced as "commandism."

Popular Resistance

Coercive tactics would not be necessary if the majority of the population were readily persuaded by the rationale for late marriage and birth control and accepted family planning and sterilization without a struggle. From all indications, however, such is not the case. Early marriage and early childbearing are deeply rooted in traditional Chinese culture and strongly resisted efforts to dislodge them during the first and second birth control campaigns. Numerous descendants were considered the key to happiness and prosperity, a source of security in old age, and an expression of filial piety. Some people believed that childbearing was the dictum of fate and that to tamper with the process could invite the wrath of Heaven. Some also felt that contraception was immoral, that it could have an adverse effect on health, and that the subject was too embarrassing to talk about.[27]

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[20] "Strengthen Leadership Over the Work Relating to Late Marriage and Birth Control," Shanghai, *Wen-hui pao* (*WHP*), Jan. 28, 1973.

[21] Hangchow radio, Chekiang Provincial Service, Jan. 21, 1976; FBIS, No. 15, Jan. 22, 1976, p. G3.

[22] NCNA, Peking, Nov. 17, 1975; FBIS, No. 226, Nov. 21, 1975, p. K2.

[23] NCNA (English), Peking, Sept. 23, 1973; FBIS, No. 185, Sept. 24, 1973, p. B2.

[24] *Nan-fang jih-pao* commentator, "Seriously Do a Good Job of Family Planning Work," Canton, *Nan-fang jih-pao* (*NFJP*), July 10, 1973.

[25] Party Committee of the T'ai-hu Fishery Commune, Wuhsi Municipality, Kiangsu Province, "Effectively Strengthen the Party's Leadership Over the Family Planning Work," *JMJP*, July 30, 1973.

[26] "Notes on Discussions with Mrs. Lyou," Department of Defense Unclassified Intelligence Report, No. 6-842-0544-76; William L. Parish, "Birth Planning in the Chinese Countryside," paper presented at the annual meeting of the American Sociological Society, New York, August 1976, pp. 11-12; and "Tutu's Village," *China News Analysis*, No. 1034, Mar. 19, 1976, p. 4.

During the third campaign there have been fewer specific references in news items to the kinds of resistance encountered among the masses than in the two earlier campaigns. In 1968 there was much concern, particularly in Shanghai about a "wave of getting married now" that was sweeping through some factories without much opposition from the cadres, who seemed fearful of incurring the ill will of the youthful offenders by reproaching them.[28] The "wave" was apparently on a scale sufficient to cause a rise in the birth rate of the municipality.[29] There were complaints that youths were obsessed with personal affairs,[30] that they had succumbed to the "fad of falling in love," [31] and that the "unhealthy practice of dating and marriage at an early age exists * * * in factories, rural areas, and schools." [32] In the next few years there were explicit references to the persistence of the old ideas that begetting children early assures a secure future,[33] that sons are preferable to daughters,[34] and that more children mean greater happiness.[35]

More often, however, popular resistance is condemned in abstract terms. There have been repeated references to the influence of old habits and the "bourgeois ideology," [36] forces which are admittedly "hard to extinguish" [37] and "still play a corrosive and disruptive part today." [38] It was recognized that the "transformation" of the old ideas would require hard work for "a long, long time" [39] because they were so "deep-rooted." [40] Even as late as November of last year, authorities in Shensi Province, which claimed "great success" in birth control work, acknowledged that "it is by no means easy to make a clean break with traditional concepts on the question of parenthood." [41] Sometimes the old ideas are denounced in more vehement terms as a "pernicious influence," as "feudal, bourgeois, revisionist concepts," as "reactionary fallacies," and as "remnant poisons" spread by Liu Shao-ch'i, Lin Piao, Confucius, and Mencius and their "agents."[42] Besides these indefatigable opponents there are ubiquitous "class enemies," sometimes described as a "handful" but evidently on hand almost everywhere, who engage persistently in unspecified acts of "interference" and "sabotage." [43] The resistance of the "class enemies" is said to be "inevitable." [44] They are accused of taking advantage of any confusion that occurs to carry out "undermining activities." [45] In 1968 the class enemies were said to have hit some "young rebel fighters" with their "sugar-coated bullets," [46] and in 1976 the struggle between the "two classes and the two lines" was still being described as "fierce." [47] The extensive discussion of popular resistance that has continued throughout the third birth control campaign up to the present time clearly indicates that opposition is continuing, that some of it is relatively aggressive, and that it involves a significant proportion of the worker and peasant masses.

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[27] For further details, see John S. Aird, "Population Policy and Demographic Prospects in the People's Republic of China," pp. 250–253 and 295–297.

[28] "Revolutionary Youths Should Care for the Affairs of State and Oppose Early Marriage; Revolutionary Cadres Should Boldly Guide Youths to Attain Healthy Growth," *WHP*, Shanghai, Apr. 23, 1968; American Consulate General, Hong Kong, *Survey of China Mainland Press*, (*SCMP*), No. 4181, May 20, 1968, p. 17.

[29] Commentator, "T'i-ch'ang wan-hun" ("Promote Late Marriage"), *WHP*, Jan. 22, 1968, p. 3.

[30] "Revolutionary Youths * * *," loc. cit.

[31] "Stem the Evil Wind of Falling in Love and Getting Married Early Among Literary and Art Circles," *WHP*, July 28, 1968: *SCMP*, No. 4250, Sept. 4, 1968, p. 17.

[32] Shanghai radio, Shanghai City Service, July 27, 1968: FBIS, No. 149, July 30, 1968, p. C5.

[33] Hung Sung, *Ch'e-ti p'i-p'an k'ung meng chih-tao* (*Thoroughly Criticize the Teachings of Confucius and Mencius*), Shanghai, February 1971.

[34] Soong Ching-ling, "Women's Liberation in China," *Peking Review*, No. 6, Feb. 11, 1972, p. 7.

[35] "Strengthen Leadership Over the Work Relating to Late Marriage and Birth Control," *WHP*, Shanghai, Jan. 28, 1973.

[36] "Firmly Destroy Old Habits, Insisting on Late Marriage," *JMJP*, Aug. 31, 1969; *SCMP*, No. 4495, Sept. 15, 1969, p. 5.

[37] Liang Yu-ken, "Business Type Marriages Should Cease," *NFJP*, Feb. 6, 1970, p. 3.

[38] CCP Committee of Ch'u-hsi Commune, Chieh-yang County, "Vigorously Criticize the Concept of 'Inferiority of Women to Men' and Do a Good Job in Planned Parenthood," *NFJP*, Feb. 14, 1975.

[39] Hangchow radio, Chekiang Provincial Service, May 28, 1975; FBIS, No. 105, May 30, 1975, p. G1.

[40] Tsinan radio, Shantung Provincial Service, Feb. 27, 1976; FBIS, No. 41, Mar. 1, 1976, p. G9.

[41] Sian radio, Shensi Provincial Service, Nov. 23, 1977, FBIS, No. 228, Nov. 28, 1977, p. M4.

[42] For examples, see Liang Yu-ken, *loc. cit.*: "Planning Childbirth and Promoting Late Marriage," *I-liao wei-sheng tzu-liao* (*Medical and Health Data*), No. 5, Shanghai Publishing Revolution Group, Shanghai, July 1970; NCNA, Peking, Feb. 6, 1975; FBIS, No. 29, Feb. 11, 1975, p. K1; Nanning radio, Kwangsi Regional Service, Feb. 9, 1975; FBIS, No. 28, Feb. 10, 1975, p. H5; CCP Committee of Ch'ü-hsi Commune, *loc. cit.*; Tsinan radio, Shantung Provincial Service, Mar. 25, 1975; FBIS, No. 64, Apr. 2, 1975, p. G8; and Hangchow radio, Chekiang Provincial Service, May 28, 1975; FBIS, May 30, 1975, p. G1.

Resistance is by no means confined to the rank and file. It also affects the cadres, as during the two earlier campaigns. In the early years of the third campaign there was a tendency to pay attention to birth control once a year when the campaign was activated but to turn to other concerns during the remainder of the year. One result of this approach was that "some comrades" thought that, compared to other assignments, family planning work was a "soft task" and could be left to women cadres and health departments.[48] Throughout the 1970's there have been repeated calls to "strengthen leadership" over birth control work.[49] Leaders in some areas have been criticized because they did not "grasp it firmly enough"; they were advised to "grasp it several times a year and grasp it firmly and well." [50] Still there are cadres in the local Party committees, who think that "birth control is unimportant" [51] or that it is less important than production.[52] One province sent out a circular late in 1977 calling on the family planning cadres to "rectify their style of work" and to "do less meaningless talking so that they can get more work done." [53] The net impression created by these injunctions is that many of the cadres in the Party committees, in the health organs, and even in the planned parenthood departments are not highly motivated toward birth control work and only push it when pushed to it themselves. Parrish and Whyte learned from Kwangtung refugees they interviewed in Hong Kong that there are still many villages that pay little attention to birth control. They quote one, an official who was responsible for birth control in her brigade, as saying:

> The Government set a goal of not more than two children per family, and at most four children. But most families had at least three or four children, six

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[43] For examples, see Shanghai radio, Shanghai City Service, Jan. 13, 1968; FBIS, No. 13, Jan. 18, 1968, p. DDD7; League Branch of Pai-ts'un Brigade, An-p'ing Commune, Hsi-yang County, Shansi, "Revolutionary Young People Should Set the Pace in Changing Customs and Traditions," *JMJP*, Nov. 20, 1972; *SCMP*, 5268, Dec. 4-8, 1972, p. 13; "Leadership Should Be Fully Strengthened," *NFJP*, Jan. 18, 1975; Huhehot radio, Inner Mongolia Regional Service, Jan. 21, 1976; FBIS, No. 15, Jan. 22, 1976, p. K1; and Tsinan radio, Shantung Provincial Service, Feb. 27, 1976: FBIS, No. 41, Mar. 1, 1976, p. G9.

[44] "Do a Serious Job in the Work of Family Planning," *NFJP*, Dec. 7, 1973.

[45] Tsinan radio, Shantung Provincial Service, Dec. 20, 1974; FBIS, No. 247, Dec. 23, 1974, p. G5.

[46] "Stem the Evil Wind * * *," *loc. cit.*

[47] Chi Wen, "Late Marriage and Birth Control for Revolution," *Ch'un-chung i-hsüeh* (*Popular Medicine*), No. 1, Jan. 1976, pp. 7-9.

[48] Party Committee of the T'ai-hu Fishery Commune, Wuhsi, Municipality, Kiangsu Province, *loc. cit.*

[49] Some provinces are still issuing such calls. See Foochow radio, Fukien Provincial Service, Jan. 24, 1978; FBIS, No. 18, Jan. 26, 1978, p. G3.

[50] Nanning radio, Kwangsi Regional Service, Jan. 13, 1975; FBIS, No. 9, Jan. 14, 1975, p. H4.

[51] Kunming radio, Yunnan Provincial Service, Jan. 21, 1977, FBIS, No. 17, Jan. 26, 1977, p. J3.

[52] Kweiyang radio, Kweichow Provincial Service, Aug. 10, 1975; FBIS, No. 155, Aug. 11, 1975, p. J1.

[53] Hangchow radio, Chekiang Provincial Service, Dec. 26, 1977; *JPRS*, No. 70, 533, Jan. 24, 1978, p. 60.

was not uncommon and some had 10 or 11. Even officials ignored the targets, so why should the peasants follow them * * * ? [54]

The Relapse During the Successional Struggle

The general impression conveyed by PRC news dispatches on birth control work between 1973 and 1976 is that the work was making significant advances, particularly in the leading municipalities and provinces. As late as November 1976, with the successional struggle already concluded and the consolidation of Hua Kuo-feng's victory apparently well under way, continuous progress in birth control was being claimed by several provinces.[55] News items on birth control seem to have been somewhat less abundant in 1976 than in the previous year, but there was no sign of increasing difficulties.

Then, rather startlingly, a Kwangtung Province dispatch in December 1976 reporting on a provincial birth control conference alleged that the "gang of four" had been opposing birth control along with other domestic policies. The "gang" were charged with spreading "various fallacies" in order to cause "confusion in people's thinking" in respect to a number of policies, including birth control. The specific accusation was that Chiang Ch'ing had taken advantage of the campaign for equal treatment of women to assert that—

> In the wake of the development of productive forces those who will rule the country in the future will be female comrades. A woman, too, can be the monarch. Even under communism there can be an empress.

She also reportedly said that "women are the most basic thing in productive forces, which are produced mainly by women." These statements have a certain flamboyance that is not out of character for Chiang Ch'ing but on the surface, at least, seem to amount to little more than a display of feminist hyperbole. Instead, they were interpreted to mean that Chiang Ch'ing wanted to usurp state power and become an empress and also as proof that she thought women should give birth to children instead of plunging into revolution.[56] From this point onward one province after another reported "interference and sabotage" by the "gang" in connection with birth control work.

The idea that Chiang Ch'ing and her associates actually opposed birth control is difficult to credit. During the apex of her power, when her faction was able to suppress mourning for Chou En-lai in spite of his popularity and to send Teng Hsiao-p'ing back for a time into the limbo from which he had just emerged, there was no visible lessening of support for birth control. On the contrary, official endorsements were on the increase. The identification of Mao with the campaign was carried further than ever before, something which Chiang Ch'ing might have prevented if she had wanted to, for a major part of her erstwhile power seems to have depended upon her relationship with Mao and her claim as interpreter of his writings and his preferences.

Instead, what seems to have happened is that the political disturbances associated with the successional struggle following Mao's death created enough uncertainty throughout the political-administrative system to cause a suspension of the pressures for birth control, which, in view of the extent of popular resistance and the reluctance of the cadres to "strengthen leadership" over the work, caused an immediate relaxation. That it was political uncertainty rather than opposition from the "gang" that caused a relapse in birth control work is suggested in a December 1976 report of a provincial birth control conference in Szechwan. At the meeting the "gang" were once again denounced for "interference and sabotage," but the specific charge was that they went through the public health and birth control departments purging "capitalist roaders" and "agents of Teng Hsiao-p'ing" and, as a result, "many cadres were harmed and the Party organizations of many units were paralysed or semi-paralysed." [57]

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[54] William L. Parish and Martin K. Whyte, *Village and Family in Contemporary China*, forthcoming. Cited in Fox Butterfield. "Family Ties in Rural China Seem More Binding Than Peking's Rule," *New York Times*. Dec. 19, 1977, p. 18.

[55] For example, see "Maternity and Child Care in Multi-National County," NCNA (English), Nanning, Aug. 12, 1976; *SCMP*, No. 6162, Aug. 20, 1976, p. 205; Huhehot radio, Inner Mongolia Regional Service. Oct. 8, 1976; British Broadcasting Corporation, *SWB*, Nov. 3, 1976, FE/W902/A/1; Changsha radio, Hunan Provincial Service, Nov. 14, 1976; FBIS; No. 223, Nov. 17, 1976, p. H15; and Kunming radio, Yunnan Provincial Service, Nov. 26, 1976; FBIS, No. 231, Nov. 30, 1976, p. J3.

[56] Canton radio, Kwangtung Provincial Service, Dec. 12, 1976, FBIS, No. 242, Dec. 15, 1976, p. H16.

As the campaign against the "gang" gathered momentum, the evils attributed to them multiplied. All that had gone wrong in recent years in whatever field of endeavor, including birth control, was added to the bill of particulars against them. Their sabotage of birth control was said to have gone on "over the past few years." [58] "Crimes" formerly charged to Liu Shao-ch'i were added to the list of their offenses, such as claiming that "farmers have no need for birth control," warning cadres not "interfere with early marriage," and spreading "reactionary, corrupt, capitalist thoughts to corrupt and poison youth." Chiang Ch'ing was said to have argued that "using movies to propagate birth control is not appropriate" and to have "openly opposed" unspecified instructions by Chou En-lai.[59] Another source amplifies the latter charge. A film entitled "Family Planning" prepared by the Peking Scientific and Educational Film Studio in 1973 was personally approved for distribution by Chou, but his decision was allegedly overruled by Chiang Ch'ing, who "arbitrarily consigned this film to the back shelf." [60]

There is very little substantive indication as to how seriously the struggle between the supporters of the "gang" and those of Hua Kuo-feng may have affected birth control work. One source says that "the resulting damage was very deep" [61] and another that "we cannot underestimate the influence of the gang of four's interference and satotage," [62] but neither goes into particulars. A Shensi Province news item says that "due to the confusion caused by the gang of four in recent years, feudal customs and bourgeois ideas have to some extent come to the fore on the question of marriage," but the examples refer to arranged marriages, lavish wedding banquets, and exchanges of gifts.[63] In several other instances, news items claiming that the "gang" undermined birth control work also claim significant progress in birth control during 1976.[64] A news item that blames the "gang" for "ruining the birth control program" in a Kwangtung prefecture adds that its population growth rate "gradually dropped to 10.68

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[57] Chengtu radio, Szechwan Provincial Service, Dec. 21, 1976: FBIS, No. 248, Dec. 26, 1976, p. J2.

[58] Kunming radio, Yunnan Provincial Service, Jan. 21, 1977; FBIS, No. 17, Jan. 26, 1977, p. J3.

[59] "Under the Guidance of Chairman Mao's Brilliant Thoughts, Great Achievements Were Accomplished in National Birth Control." NCNA, Peking, Feb. 21, 1977; *Chung-kuo hsin-wen* (*China News*), Hong Kong, Feb. 22, 1977; *JPRS*, No. 69,791, Sept. 14, 1977, p. 42.

[60] CCP Committee of Lo-t'ing County, Hopeh, *Kuang-ming jih-pao*, Peking, Feb. 12, 1977: American Consulate General, Hong Kong, *Survey of People's Republic of China Press* (*SPRCP*), No. 6304, Mar. 22, 1977, p. 52.

[61] "Under the Guidance . . .," *loc. cit.*

[62] Hofei radio, Anhwei Provincial Service, Feb. 4, 1978: FBIS, No. 26, Feb. 3, 1978, p. G2.

[63] Sian radio, Shensi Provincial Service, Feb. 3, 1978; FBIS, Feb. 8, 1978, p. M4.

[64] Shihchiachuang radio, Hopeh Provincial Service, Feb. 3, 1977; FBIS, No. 27, Feb. 9, 1977, p. K1; and Changchow radio, Honan Provincial Service, Feb. 3, 1977; FBIS, No. 24, Feb. 4, 1977, p. H1.

per thousand" in 1976.[65] Either the damage or the progress must have been exaggerated in such cases.

Thus far, only one instance has been reported of a unit that actually experienced a rising birth rate during the successional struggle, and the report comes not through PRC news channels but from a member of a U.S. family planning team that went to China in August and September 1977. Among other places, they visited Wan-tou People's Commune in Han-chiang County, Kiangsu, where they were told that as a result of "interference by the gang of four" the 1976 birth rate in the commune was 16.8 per thousand compared with 14 per thousand in 1973. But, as one of the members of the team noted, the absolute figures for births and population yield a 1976 birth rate of 18 per thousand.[66] Depending upon which 1976 rate is used, the figures imply a rebound of 20 to 30 percent in the birth rate in the 3-year period. A rapid rise in the numbers of young people reaching the permissible ages for marriage may have had something to do with the rising birth rate, but could scarcely account for a rebound of that magnitude.

What these fragments suggest is that reverberations from the successional struggle did have an adverse effect on birth control and that the absence of descriptive evidence or data in the news dispatches during 1976 that would reflect the fact is not to be taken as a contrary indication. The news media in the PRC seldom mention adverse developments of any kind and then only in generalities; they almost never provide data that would indicate the severity of the consequences.

The Recent Intensification

One obvious purpose of the press campaign attacking the "gang of four" as the enemies of birth control is to reaffirm and reinforce the popular perception that the current leadership is wholeheartedly behind the campaign and perhaps to warn opponents of the program that they too may be subject to denunciation. Another purpose is to use the mobilization of cadres and masses against the "gang" to add impetus to the birth control effort.

Certainly there are many indications that official pressure for control of population growth has increased markedly since the 11th Party Congress in August 1977. An order to step up the tempo may have been issued to the delegates at the Congress, but if so it has not been made public. There was also a "National Report Meeting on Birth Control Work" in the fall of 1977; the place and date have not been indicated, but its "spirit" was conveyed to participants at a regional family planning meeting in Inner Mongolia some time prior to November 11 and at a provincial conference on birth control and public health in Kiangsi Province between October 26 and November 6.[67] Presumably other provinces were also spreading the word by one means or another at the same time, for in November and December 1977 the signs of intensification in local items on birth control began to multiply. Inner Mongolia announced that it had made a preliminary projection of the planned population of the region for the year 2000 and stressed that it was "imperative to mobilize the whole Party" in the promotion of birth control.[68] Shensi asserted that "the Party committees must get a tight and firm grasp of birth control work." [69] Hupeh declared that "the whole Party must mobilize to grasp birth control work well" and pointed out that "birth control is an essential task." [70] Birth control circulars issued by Anhwei "demanded" an increase in promotional efforts.[71] Several provinces called for a "new upsurge" in birth control work,[72] and a Peking newspaper urged that the work be conducted "with great fanfare." [73] A Kwangtung circular "demanded" that the promotion of planned parenthood be combined with "the third campaign of exposing and criticizing the 'gang of four' " and stated that "it is imperative to relentlessly grasp and implement the task." [74] The language used in exhorting the local cadres had become more aggressive.

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[65] "Swatow Birth Control Shows Brilliant Results; Population Growth Rate Drops to 10 Per Thousand, Natural Rate of Population Growth in Tu-tung County, Kiangsu Province at 3.25 Per Thousand," NCNA; Canton, Feb. 15, 1977, *Ta-kung pao*, Hong Kong, Feb. 16. 1977, p. 3; *JPRS*, No. 69,791, Sept. 14, 1977, p. 38.

[66] Frederick S. Jaffe, "China Trip Notes: 1977," The Alan Guttmacher Institute, p. 41.

[67] Huehhot radio, Inner Mongolia Regional Service, November 11, 1977; FBIS, No. 222, November 17, 1977, p. K3; and Nanchang radio, Kiangsi Provincial Service, November 21, 1977; FBIS, No. 232, December 2, 1977, pp. G5–6.

The objectives and the tactics also implied a general escalation. Hupeh Province directed birth control workers to advocate that no couple have more than two children,[75] the first open admission that this quota was now to be applied to everyone. More provinces began to call for a strict adherence to population growth plans.[76] Chekiang Province insisted that "plans for controlling population growth must be vigorously carried out," [77] and a Hupeh symposium on birth control sent out a letter to various local officials and functionaries saying that in accordance with "Chairman Hua's instruction on conducting emulation, we must conduct a vigorous, grand-scale emulation in birth control." [78] To make sure that the propoganda was followed by vigorous actions, several units gave instructions about tightening investigation and supervision work, "conducting penetrating investigations," and organizing "inspection corps." [79]

The intensification of the birth control campaign undoubtedly signals a stepped up effort at mass indoctrination in the new value system relating to family formation and the role of women and probably also the wider use of extreme social pressures and other, more direct forms of coercion in order to fulfill or overfulfill targets for reduction of population growth rates. It is also likely that there will be more frequent use of atypical, distorted, and falsified vital data and misleading estimates in the reports from local units to higher administrative levels in order to sustain the impression that central policies are being fully implemented.

Results of the Current Campaign

Granted that the official commitment to birth control is now firm and that all-out efforts are now being made to secure universal compliance with the objectives of the campaign, what degree of success has been attained thus far and what are the prospects for the future? Domestic propaganda tends to emphasize progress in birth control work except in certain provinces which are admittedly laggard, and the vital rates and population growth rates cited for selected units, from rural brigades and city streets to provinces, represent absolutely phenomenal results. Foreign visitors, and particularly those that have no demographic expertise and are not China specialists, are usually very much impressed with what they are told and shown and sometimes jump to the conclusion that what is said to be happening in the units they visit is also happening in the rest of the country. A few claim more success for the Chinese effort than do the Chinese themselves. Some others proceed to explain how the Chinese triumph was achieved and to point out its "lessons" for the rest of the world. As a result, there is a widespread impression outside China that the birth control effort has been a resounding success.

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[68] Huhehot radio, Nov. 11, 1977, *loc. cit.*

[69] Sian radio, November 23, 1977, *loc. cit.*

[70] Wuhan radio, Hupeh Provincial Service, December 20, 1977; FBIS, No. 246, December 22, 1977, p. H2.

[71] Hofei radio, Anhwei Provincial Service, December 22, 1977; *JPRS*, No. 70,533, January 24, 1977, p. 86.

[72] Foochow radio, Fukien Provincial Service, January 24, 1978, FBIS, No. 18, January 26, 1968, p. G4; and Changchun radio, Kirin Provincial Service, February 12, 1978: FBIS, No. 30, February 13, 1978, p. L1.

[73] "Family Planning Must Be Openly Taught," *Kuang-ming jih-pao*, Peking, January 31, 1978, p. 1; FBIS, No. 32, February 15, 1978, p. E23.

[74] Canton radio, Kwangtung Provincial Service, February 1, 1978; *JPRS*, No. 70,798, March 17, 1978, p. 53.

[75] Wuhan radio, Hupeh Provincial Service, December 20, 1977; *JPRS*, No. 70,533, January 24, 1977, p. 87.

[76] Hofei radio, Anhwei Provincial Service, January 18, 1978: FBIS, No. 16, January 24, 1978, p. G10; Hangchow radio, December 26, 1977, *loc. cit.*: and Harbin radio, Heilungkiang Provincial Service, January 6, 1978; FBIS, No. 7, January 11, 1978, p. L10.

[77] Hangchow radio, December 26, 1977, *loc. cit.*

[78] Wuhan radio, Hupeh Provincial Service, December 20, 1977;*J PRS*, No. 70,533, January 24, 1978, p. 88.

[79] Wuhan radio, December 20, 1977; p. 87; Hangchow radio, Chekiang Provincial Service, December 31, 1977; FBIS, No. 1, January 3, 1978, p. G6; and "Family Planning Must Be Openly Taught," *loc. cit.*

Any such conclusion goes far beyond the warrant of present evidence and is at least premature. What too many impressionable foreigners fail to take into account is that the units from which the publicized vital rates come, and the units foreigners are taken to visit, are those which are believed to be outstandingly successful in birth control work. They are cited in domestic propaganda as examples for emulation by less advanced units, which are presumably always in the majority. According to current policy, all administrative units from the provincial level down are supposed to select one or more of their components that are in the lead in birth control work to serve as "typical examples" for the other components. There is evidently considerable pressure to come up with "typical examples" that are comparable with those in other areas that have been featured in press and radio propaganda. One news item alleges that in recent years the Party newspapers have been guilty of fabricating "typical examples" and that some journalists have even argued that such fabrications were necessary and legitimate.[80] No other details are provided, hence it is impossible to say whether birth control claims have been among the fabrications, but the incentives for fabrication are the same for birth control as for other campaigns in which the "typical example" approach is used. Local cadres need to show that they are conscientiously implementing centrally mandated programs. In any case, it is obvious that "typical examples," whether real or fabricated, are atypical. One cannot generalize from the reported experiences of these units about program implementation, public response, and demographic results in the rest of China.

Aside from fabrication, there are serious questions about the quality of the data that are collected and reported by the exemplary units. The course of vital registration in the PRC never has run smooth. The local population records, which are dependent upon voluntary reporting of births, deaths, migration, and other changes in household composition, have repeatedly lapsed and been revived by field investigations only to lapse once more. The reporting of deaths has been incomplete because families have been reluctant to give up the ration allotments for deceased members. The reporting of births has also been lax because of traditional fears that reporting could bring bad luck, because heads of household saw no point in reporting the births of infants that died before they could be registered, and because of a profound reluctance to have anything to do with the police, who were put in charge of registration throughout the country in January 1956. With the mounting pressure to reduce birth rates in order to hold to target growth rates and the increasing use of penalties for those who continue to have children out of turn, such as the withholding of rations for unauthorized children, neither officials nor heads of household have as much incentive to report births as they had a few years ago.

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[80] Nanning radio, Kwangsi Chuang Regional Service, January 12, 1978; FBIS, No. 10, January 16, 1978, p. H16.

The statistical evidence for underregistration is fragmentary, as is most of the demographic evidence from the PRC, and largely inferential. Several journal articles published in the 1950's allude to defects in registration data, but none of the authors seem to have been aware of the possibility that underregistration of births and deaths might be a serious problem. Most assumed that the registration system was working as it was supposed to work, and therefore they did not attempt to check the data for completeness. One of the most sophisticated of the statisticians who wrote about population data in the 1950's conceded that the deaths of infants that die soon after birth, illegitimate infants, and abandoned infants tend to be omitted, but he was confident that all other deaths and virtually all births were recorded.[81]

However, the few vital data available for the 1950's suggest that both births and deaths were underreported. The vital rates for 16 rural areas in the early 1950's given in a paper by the Western trained demographer Ch'en Ta show a positive correlation between birth and death rates, a circumstance strongly implying that the level of the rates was determined by the relative completeness of registration.[82] The vital rates for seven municipalities for the years 1952–56 show acute underregistration of births in the first 2 years, a sudden surge of registration in 1954, the year that food and cloth rationing was instituted, and a subsidence in subsequent years. The death rates for six of the seven municipalities show a sharp drop in 1954 and a rebound in the next year.[83] These figures suggest that the registration system was highly susceptible to the influence of external conditions but the effects of rationing on reporting habits were largely temporary.

In the 1960's, virtually no vital data were published for any administrative unit in the PRC—not even for those that were said to be making progress in birth control work. Some data for the 1960's were released during the 1970's, but it is not certain that the data belatedly made public had been compiled during the 1960's. Many local vital rates for the 1970's have been cited in news dispatches from the PRC or given to foreign visitors. Unlike the total population figures for provinces and smaller units, the vital rates that have been appearing in the news media are usually precisely dated, but they are never associated with population totals, and they seldom include figures for more than 2 years. Visitors have been able to obtain longer series, occasionally in combination with total population figures, but the series sometimes contain puzzling anomalies.

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[81] Yang Chien-pai, "Ha-erh-pin Tung-fu-chia ch'ü chü-min shou-ming-piao, 1953–1955 nien" ("Life-Table of the Population of Tung-fu-chia District, Harbin, 1953–1955"), *I-hsüeh shih yü pao-chien tsu-chih* (*Medical History and Health Organization*), Vol. 2, No. 1, March 25, 1958, pp. 9–17. Yang was speaking only of the data for a single district of Harbin Municipality.

[82] Ch'en Ta, "New China's Population Census of 1953 and its Relations to Natural Reconstruction and Demographic Research," International Statistical Institute, Stockholm, August 1957, p. 25.

[83] Roland Pressat, "La Population de la Chine et son Economie," *Population*, Vol. 13, No. 4, October–December 1958, pp. 572–573.

The most conspicuous feature of the current vital rates is the rapidity with which they change. Even large rural units report spectacular declines in the birth rate, in some cases during the early 1970's before the birth control campaign was intensified. A Shantung county claims that its birth rate dropped from 23.4 per 1,000 in 1970 to "10 or so" in 1974—more than 50 percent in 4 years—and a Kansu county reports a drop from 42 in 1971 to 27 in 1972—a 35 percent reduction in 1 year.[84] Natural increase in a Hopeh county reportedly went from "over 15" in 1972 to 3.83 in 1974—a decline of about 75 percent in 2 years—and a county in Kweichow claimed a reduction from 21.8 in 1975 to 9.7 in 1976—down by more than half in 1 year.[85] Birth rates for 9 communes visited by the Wheat Studies Delegation in 1976 ranged from 15.2 down to 5.5 per 1,000, but the associated death rates ranged from 7.4 down to 2.0 and were below 5 per thousand for 5 of the 9 communes.[86] The commune officials obviously did not realize that these rates were implausible and could be taken as prima facie evidence that the vital records are defective or they would not have made them available to foreign visitiors. Since low birth and death rates are taken as proof of success in birth control and health work and since incomplete registration contributes to the illusion of exceptional performance, local officials who suspect that their data are wrong in the right direction may be in no hurry to improve their accuracy.

Recently there have been several reports of false accounting and falsified data for units as large as counties that indicate considerable boldness in the deception of higher authorities. One such account concerns a county in Kansu Province that had actually suffered a reduction of over 20 percent in grain output but was publicly applauded by provincial officials for having an increase in grain production.[87] The fraud was attributed to the "gang of four" and strongly condemned, but the conditions that give rise to such deceptions have not been eliminated. In fact, the use of population growth targets, based on Hua Kuo-feng's new call to get the national population growth rate below 1 percent in the next 3 years, and the institution of an emulation campaign among birth control workers [88] may only heighten incentives to falsify population data. Two other factors that will probably increase the pressures on the local cadres are changing age composition and rising marriage rates. The numbers of women in the childbearing ages have been increasing sharply during the 1970's and will continue to do so during the 1980's, because the higher birth rates and lower infant mortality rates in the early 1950's combined to enlarge considerably the surviving cohorts of children born during those years who are now reaching the permissible ages for marriage. If the campaign for late marriages has had some success in delaying age at marriage, the temporary remission in marriage rates during the transition to a later age at marriage may now be coming to an end, which would mean increasing numbers of newly married couples eligible to begin having children. Even greatly increased family planning efforts may not suffice to prevent an upturn in the crude birth rate in many areas. Hence local target growth rates derived by extrapolating the trend of previous natural increase rates and intended to conform with Hua's national target increase rate for 1980 may prove impossible to realize in actuality. If even the defective vital data from the local records do not show the required progress, some cadres may be driven by necessity to invent their own.

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[84] Tsinan radio, Shantung Provincial Service, Jan. 28, 1975; FBIS, No. 21, Jan. 30, 1975, p. G6, and Rewi Alley, "Through the Kansu Panhandle and Down the Old Silk Road," *Eastern Horizon*, Vol. 13, No. 1, 1974, p. 36.

[85] NCNA, Peking, Feb. 6, 1975; FBIS, No. 29, Feb. 11, 1975, p. K1; and Kweiyang radio, Kweichow Provincial Service, Mar. 19, 1977; FBIS, No. 54, Mar. 21, 1977, p. J1.

[86] Wheat Studies Delegation Report, 1976, p. 58.

[87] Lanchow radio, Kansu Provincial Service, Sept. 26, 1977; FBIS, No. 188, Sept. 28, 1977, pp. M1-2.

[88] Hangchow radio, Dec. 26, 1977, *loc. cit.*

THE NEW PROVINCIAL POPULATION TOTALS

Previous Provincial Figures

Provincial population totals for the PRC have seldom been issued in complete sets implying comparability in respect to reference date and quality of data. Prior to the 1953 census, Chinese atlases and handbooks cited provincial figures from the middle 1940's or compiled figures from provincial newspapers and other sources purporting to refer to the early 1950's, but the figures were mutually contradictory and those for particular provinces varied considerably from one compilation to another.[89] The provincial figures obtained in the 1953 census were generally of a much larger magnitude than those shown in previous compilations, and, in view of the comparatively elaborate and systematic methodology of the census effort, were presumably the most reliable provincial population data in China's history.[90] They were thenceforth widely used both in the PRC and abroad for any purpose for which provincial figures were required.

A not entirely comparable set of provincial population figures as of yearend 1954, said to have been based on the national registration system set up during a period of about 2 years beginning in the fall of 1954, were presented in a journal article in 1957 by a Chinese geographer.[91] Provincial newspapers occasionally cited isolated provincial population figures, and, in one or two cases, a series of figures, for various years during the middle 1950's but the figures were not always consistent with the census figures and some were obviously implausible.

In 1959, the State Statistical Bureau issued a set of provincial population figures for yearend 1957 which, with a few exceptions, appear to be generally comparable with the 1953 census figures, although their sum is not consistent with national population totals for 1955 and 1956 previously published by the Bureau in its statistical journal.[92]

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[89] For a discussion of these figures, see Aird, "Population Growth," pp. 230–235.

[90] The provincial figures as originally compiled were released in a short communique giving the results of the census in November 1954. See "Communique of Results of Census and Registration of China's Population," NCNA, Peking, Nov. 1, 1954; *CB*, No. 301, Nov. 1, 1954, pp. 1–2. Subsequent official and semiofficial issuances of the figures adjusted them for interim changes in provincial boundaries but adhered to the same overall population total.

[91] Hu Huan-yung, "Chung-kuo ke-sheng ch'ü mien-chi jen-k'ou chih shih-t'u" ("A Graph of the Area and Population of China by Province and Region??), *Ti-li chih-shih* (*Geographical Knowledge*), No. 9, Sept. 14, 1957, pp. 390–391.

[92] State Statistical Bureau, *Wei-ta te shih-nien—Chung-jua jen-min kung-ho-kuo ching-chi ho wen-hua chien-she ch'eng-chin te t'ung-chi* (*Ten Great Years—Statistics on Economic and Cultural Construction Achievements in the People's Republic of China*, People's Publishing House, Peking, Sept. 1, 1959, p. 9; and "Data on China's Population from 1949 to 1956," *T'ung-chi kung-tso* (*Statistical Work*), No. 11, June 14, 1957; American Consulate General, Hong Kong, *Extracts from China Mainland Magazines*, No. 91, July 22, 1957, pp. 22–25.

This was the last official compilation of provincial figures ever to be released by the PRC. Some kind of population investigation, presumably an effort to update existing population records, was undertaken in the summer of 1964, but the results were never officially issued. No population total for 1964 has ever been disclosed. What seem to be the 1964 provincial population figures in units of 10,000 appeared in several atlases published in the PRC between 1974 and 1976, but the sources do not date the figures or otherwise disclose their origin. If indeed these are the 1964 provincial figures, many of them are incompatible with the 1953 and 1957 figures for the same provinces.[93]

From the middle 1960's until the early 1970's, news dispatches from the provincial level in the PRC cited a number of round provincial population totals in millions which are generally consistent with the atlas figures. In a few instances the figures seem to have been updated and, in the case of the provinces that acquired a large portion of northeastern Inner Mongolia in 1969, adjusted to allow for boundary changes, but, for the most part, the figures cited tended to be repeated year after year without change. By the middle 1970's, the public citation of provincial figures had virtually come to an end.

Provincial Figures Since September 1976

The new round of citings of provincial figures that began in September 1976 resembled that of the 1960's in that the figures were rounded to millions and were never explicitly dated. They also tended to appear in highly rhetorical contexts in which the implications were political rather than statistical. Once again, there is reason to believe that the figures were derived in some fashion from the results of a national effort to obtain a new count of the population. Several reports and rumors from various sources say that field investigations of the population were underway in various areas in 1972 and some indicate that the effort was nationwide.[94] In that same year a group of foreign visitors reportedly were told by Chou En-lai that a "census" was planned for "the near future."[95] As in the case of the 1964 investigation, no notice was taken of the event by PRC news media.

However, unlike the news item provincial totals of the 1960's, the figures that have been cited since 1976 have, in a number of cases, been updated, some of them several times, as though they were derived from population records or estimates that change from year to year. The updatings are not regular, and some of the updated figures may not actually be current totals. Szechwan went from 80 million, a figure cited repeatedly since 1973, to 90 million in the spring of 1977, and Honan went from 60 million, a figure first cited in 1972, to 70 million in December 1977; one cannot be sure that the 90 million for Szechwan refers to yearend 1976 or the 70 million for Honan to midyear 1977. Like the national round population totals, these figures may have been quite out of date when they first appeared.

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[93] For further discussion of the 1964 provincial figures, see John S. Aird, "Recent Provincial Population Figures," *The China Quarterly*, No. 73, March 1978, pp. 1–44.

[94] Henry S. Bradsher, "Census Taking for All China Is Reported," *The Star and News*, Washington, Jan. 15, 1973, p. B6; and Judith Banister, *The Current Vital Rates and Population Size of the People's Republic of China and Its Provinces*, unpublished Ph. D. dissertation, Stanford University, Sept. 1977, pp. 68–69.

[95] Notes on a seminar talk by Peter E. C. Chen to the Population Council on Sept. 29, 1972.

The new figures indicate provincial and national population totals much larger than those previously cited. In fact, when compared with the provincial data from official sources for 1953 and 1957, they are much more plausible than are the figures from the 1964 investigation. Although some PRC news dispatches still continue to use the figure of 800 million as a national population total, the new provincial figures, as already noted, add to a total of almost 920 million. But the growth rates since 1957 implied by some of the new figures are impossibly low and some of the others are questionable. It is likely that quite a few of the figures are either out of date or defective. The sum of a set of really current figures for all provinces would probably be well up in the 900 millions by yearend 1977.

Other Indications of the Current National Total

Since 1957, PRC officials, among them Premier Chou En-lai, have from time to time cited national population growth rates for various years which seem in some cases to have been based on estimates used for planning purposes by central government agencies. The growth rates do not form a complete series, but there are few gaps up to 1974. On the basis of these figures a maximum and minimum series of values can be reconstructed extending from 1958 through 1976. When these alternate sets of growth rates are applied to the official population total of 646,530,000 for yearend 1957, the estimated totals for yearend 1976 range from 938 million to 968 million.[96] This narrow range does not represent the full measure of uncertainty about the size of the PRC population as of that date but merely the range within which official estimates should fall if the growth rates cited by the various PRC sources are close to those used in making the estimates.

Hence both the new provincial figures and the national population growth rates point to a current population total that is fast approaching the one billion mark. Another sign that this is the magnitude of official estimates is the fact that, after holding doggedly to the obviously inadequate total of 800 millions for almost 4 years, PRC media have at last apparently been authorized to refer to China's population as 900 million. As recently as March 1978, the *People's Daily* and the New China News Agency were still citing the figure of 800 million in items reporting the closing of the first session of the Fifth National People's Congress,[97] but there had been hints recently that a change was about to take place. Prominent Chinese officials had been using the figure of 900 million in briefings of foreign visitors at least since last fall,[98] and some excerpts of a speech given in Peking by Prime Minister Mintoff of Malta which included a reference to China's population of 900 million were published in the *Peking Review* in November 1977.[99] In March 1978, at a meeting with the deputy leader of the West German Parliament, Teng Hsiao-ping made the observation that even if, in the event of war, the Soviet Union "neutralized" 200 million Chinese in the Northeast, there would still be 700 million Chinese "in fighting order." [100] Up to this point, the only references to a population of 900 million had been in conversations with foreigners or in publications that only foreigners would normally see. Then on April 1 a joint editorial in the *People's Daily*, *Red Flag*, and the *Liberation Army Daily* carried as its title a line from a poem celebrating the conclusion of the National Science Conference that included the phrase "leaping forward are the 900 million in China." [101] From this point onward, the new total may be expected to displace the figure of 800 million as the current rhetorical total for China. The new figure is already out of date; China's population should have exceeded 900 million by about 1973.

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[96] See Aird, "Recent Provincial Population Figures," p. 40.

[97] *JMJP*, Mar. 14, 1978; FBIS, No. 56, Mar. 22, 1978, p. E14; and NCNA, Peking, Mar. 5, 1978; FBIS, No. 44, Mar. 6, 1978, p. D9. In his report to the Congress on government work, delivered on Feb. 26, Hua Kuo-feng did not cite the figure of 800 million, but he did refer to China's population as one-fifth of the world's total, presumably meaining 800 million of the world's 4 billion.

[98] A group of foreign journalists heard Vice Premier Chi Teng-k'uei use the figure during a briefing in the fall of 1977. See "China's Great Leap Sideways," *The Economist*, Nov. 5, 1977, p. 103. Emily MacFarquhar is quoted in a word-of-mouth account to have heard the Vice Premier twice use the figure in Chinese (*chiu yi*). Han Su-yin also reports having heard the total cited during a recent visit to China.

[99] "Prime Minister Mintoff's Speech (Excerpts)", *Peking Review*, No. 46, Nov. 11, 1977, p. 9. This does not, of course, constitute an official endorsement of the figure, but the *Peking Review* would not have included this statement among their "excerpts" if they had found it unacceptable.

A few references to figures over 900 million have been attributed to PRC sources. Judith Banister cites an anonymous source who reportedly worked on an occasional basis for a government ministry in Peking and who claims to have seen what was presumably an official Chinese estimate that 930 million people in China received cloth rations as of midyear 1976.[102] It is not clear whether the estimators would have assumed that all Chinese presently receive cloth rations; the unregistered probably do not. Several reports by visitors to the PRC within the past 2 years have contained references to population totals of 950 million or larger. In August and September 1977 a delegation of family planning specialists made an 18-day tour of the PRC, at the conclusion of which they held a press conference in Hong Kong. An Agence France Presse report of the conference quotes one of the leaders of the delegation as saying that during the trip "Chinese officials * * * told her repeatedly that the present population was 950 million." [103] However, the report appears to be in error. Followup conversations with members of the delegation have failed to establish that any Chinese official was heard by the group using a population total of this—or for that matter any other—magnitude. A similar report that a delegation of state legislators from the United States that visited the PRC in 1976 and a second delegation that was there in September 1977 were also given the figure of 950 million by their hosts remains, as of this writing, unverified.[104]

Official estimates of the total population of the PRC may have reached or surpassed 950 million by midyear 1976, but before such a figure can be attributed to a Chinese source it must be confirmed that one or more reliable sources actually heard a Chinese official cite the figure. The reason for the extra caution is that the American Legation Office in Peking has, in its briefings of American visitors, sometimes included what it identifies as U.S. estimates of the Chinese population. The figure given out in 1976 was 950 million; that given out a year later was 966 million. These figures are rounded versions of the FDAD intermediate model estimates of 950,744,000 and 965,937,000 for midyear 1976 and midyear 1977, respectively, that were prepared in the spring of 1976. There is therefore a strong possibility that the reports of Chinese citations of 950 million may be simply misattributions of the FDAD estimate for midyear 1976.

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[100] Agence France Presse, (AFP), Peking, Mar. 23, 1978 (via Paris); FBIS, No. 57, Mar. 23, 1978, pp. A23-24.

[101] NCNA, Peking, Mar. 31, 1978, FBIS, No. 64, Apr. 3, 1978, pp. E3-7. The poem was written by Yeh Chien-ying.

[102] Judith Banister, *op. cit.*, p. 20.

[103] "PRC Population Reported to be 950 Million," AFP, Hong Kong, Sept. 6, 1977; FBIS, No. 173, Sept. 7, 1977, p. E16.

[104] This information was obtained from Mr. Karl T. Kurtz, of the Conference of State Legislators, Denver Colo.

Until very recently it appears that some foreign scholars who have prepared estimates of the population of the PRC have let their judgment be swayed by the low magnitude of the rhetorical figure of 700 million, which first appeared in PRC sources in 1966, and the figure of 800 million which displaced it in 1974. Several have substituted low base totals attributed to the 1964 investigation for the higher figures implied by the 1953 census total and the 1957 registration figure, even though Chinese sources have never given any indication that the population data of the 1950's have been abandoned. Others have assumed annual population growth rates well below those cited by Chou En-lai and other Chinese sources during the 1960's and 1970's. As a result, until recently their estimates for the 1970's tended to be closer to the rhetorical figure of 800 million than to the higher total implied by the new provincial figures. Most will probably want to adjust their figures upward hereafter.

POPULATION ESTIMATES AND PROJECTIONS PREPARED BY FDAD IN 1976

For many years the Foreign Demographic Analysis Division has been preparing estimates and projections of the population of the PRC based partly on official data and partly on estimates and assumptions in lieu of data that were judged implausible or were not available. All of the series have used the 1953 census total of 582,603,417 as a base figure, although there are indications from the postenumeration checks that the census actually undercounted the population, and the margin of undercount could have been much greater than the officially announced 0.116 percent. Except for an "official data" model constructed some years ago and the low model of the present series, none have attempted to hold to the State Statistical Bureau's totals for other years during the 1950's because the published figures seem arbitrary in some cases and internally inconsistent in others. For years since the 1950's the population totals estimated by FDAD have been derived from assumptions about trends in vital rates. None of the undated round figures cited in PRC news items have been treated as data or assigned to particular years.

The vital rates for the years 1952–57 released by official sources have also been rejected as incomplete and unreliable. They seem to have been based on unadjusted data from atypical reporting units some of which were apparently defective. For 1953 intrinsic fertility and mortality levels were selected which, applied to the 1953 age-sex distribution of the population, yielded a birth rate of 45, death rate of 22.5, and natural increase rate of 22.5 per 1,000 population, instead of the official birth rate of 37, death rate of 17, and natural increase rate of 20.

The 1953 age-sex distribution reported in articles by several Chinese scholars and apparently based on 1953 census data obtained from official sources is also somewhat implausible in view of China's probable demographic history for the prior century. The proportion of the population in the older ages is too high, the proportion at ages under 15 somewhat too low, and there seem to be too many males in relation to the numbers of females at all ages, particularly those that should have reflected the war losses of the 1930's and 1940's. An age-sex distribution derived from a model based on historical records of population growth with allowances for natural and man-made disasters was substituted for the 1953 census age-sex distribution.

The assumed trends in vital rates for the years from 1954 to the present were based on interpretations of descriptive evidence relating to factors likely to affect the levels of fertility and mortality in the PRC. Every few years, a new series of estimates was prepared incorporating changes that seemed warranted because of important economic, political, or social developments that could be expected to influence vital trends. The food crisis of the early 1960's was one such event; the wave of early marriages following the disintegration of the Maoist youth movement in 1968 was another. Until about 1972, there were virtually no vital data, even for local areas, that could be used as a basis for estimating the levels and trends in fertility and mortality in the country as a whole. Prior to that time there was no reason to expect more than a gradual reduction in the rate of population growth during the remainder of the century.

However, as the third birth control campaign began to gather momentum from 1972 onward and local progress reports began to include birth, death, and natural increase rates compiled from local records indicating a significant decline in all three vital rates in some areas, it was necessary to entertain the possibility of a much more successful effort to control population growth in the PRC than had previously been thought possible. The first estimates and projections by FDAD that reflected the changed assessment of fertility trends were those prepared in the spring of 1976.

The 1976 estimates and projections incorporated several changes in methodology as compared with previous models. An effort was made for the first time to convert descriptive information about factors affecting fertility and mortality into index values that could be applied to the annual intrinsic fertility and mortality rates to obtain more realistic year-to-year changes, and an attempt was made to derive the fertility trends and levels for the 1970's from the birth rates reported for various local units.

The factors likely to affect fertility were marriage rates, birth control and abortion, sterilization, migration, nutrition, and general economic conditions. Mortality-related factors were sanitation, medical services, nutrition, and general economic conditions. Separate series of annual index values were calculated for urban and rural areas. The index values reflected the relative significance of each factor for each year throughout the period on a scale of 0 to 10. Weights were applied to each of the factors to reflect their relative importance for the demographic parameter to which they applied. The weights had a total value of 1.0. Using the weights, four sets of composite index values were made up for fertility and mortality for the urban and the rural populations.

Terminal birth and death rates were then established for 1976 for the urban and rural components of the high and low models. For the low model, the 1976 birth rates were derived from the mean birth rates reported for the early 1970's for urban and rural units. It was assumed that the units cited in news dispatches or shown to foreign visitors were atypically successful in family planning work or had unusually defective birth records and that most other units lagged far behind in the effort to reduce birth rates. With allowance for the latter, the urban birth rate for 1976 was set at 10 per 1,000 and the rural at 20, making an overall average birth rate of 18. When the composite index values were applied to the 1953 urban and rural birth rates, the 1976 rates obtained were well above the values just indicated. It was therefore assumed that the difference represented the cumulative effect of a secular trend toward lower fertility attributable to broad sociocultural changes not included in the index factors. The two trends were therefore combined. The target death rate for 1976 was arbitrarily set at 7 per 1,000, the magnitude of the death rate reportedly used by the State Planning Commission in its own estimates. The death rates for local units in the PRC were too few to be of any use in deriving estimated death rates for urban and rural areas. Based on the national death rate, 1976 death rates of 5 and 7.5 were assumed for urban and rural areas, respectively, and the same process of establishing and combining composite index and secular trends was followed as in the case of the birth rates, in order to derive year-to-year values for the period 1953–76.

When complete sets of urban and rural birth and death rates for the years 1953–76 had thus been obtained, each series ending in an assumed target rate for 1976, the urban and rural components were assembled into national birth and death rates according to the estimated proportions of the population that were urban and rural in each year of the period. These proportions were based partly on official data on the urban and population for 1953–57 and partly on assumed levels of natural increase, the assumed or estimated volume and direction of net rural-urban migration, including involuntary relocations such as the cadre transfers and the rustication program, and assumptions about backflow.

The changes from year to year in the crude birth and death rates were converted into ratios of the starting values, which were then applied to the initial gross reproduction rate and expectation of life at birth so that the patterns of change were imposed on the intrinsic fertility and mortality measures. These values were used in trial runs on the computer and adjusted until the derived crude rates for 1976 corresponded to the national target rates.

The high model was constructed by essentially the same methods, except that the target vital rates for 1976 were arrived at by a still more arbitrary method. For the urban component, the assumed birth and death rates were 17.5 and 9 per 1,000, respectively, and for the rural component, 35 and 12.5, respectively, for 1976.

After 1976, the low model assumed that the gross reproduction rate continued to fall until it reached 100 in 1980, less than the level of replacement, after which it remained constant. The high model assumed that the gross reproduction rate declined until it reached 150 in 1985 and thereafter did not change. Mortality levels for both models continued to decline throughout the remainder of the projection period, the expectation of life at birth reaching 70 years in the low model and 60 years in the high model by the year 2000.

The intermediate model began with the same base values for 1953 as were used for the other two models, but the fertility and mortality levels for subsequent years were midway between those of the other two models. This was the model which produced a population total just over 950 million as of midyear 1976. It also had a birth rate of

28, death rate of 10, and natural increase rate of 18 per 1,000 for 1975, in which year the State Planning Commission in Peking was said to be using figures that implied national rates of about 25, 7, and 18, respectively.[105]

The low model in the 1976 series assumed a fairly pronounced and continuous downward trend in intrinsic fertility levels from 1953 onward in order to reach the birth rate of 18 and natural increase rate of 11 by 1976. The total population in the low model for 1976 was just under 900 million. The fact that the provincial figures now used in news dispatches add almost to 920 million and the evidence suggesting that official estimates should have been at least as high as 930 million by midyear 1976 indicate that growth rates in the 1976 low model were too low. Hua Kuo-feng's target growth rate of less than 1 percent by 1980 makes it extremely unlikely that the estimates on which his target was based could have included a rate as low as 1.1 percent by 1976. Some allowance must also be made for the setback to the birth control movement that resulted from the struggle with the "gang of four," and, although the Tangshan earthquake does not have great demographic significance on a national scale, its awesome death toll has a perceptible impact on the death rate for 1976 which should not be neglected. Hence all three models need to be revised to bring them up-to-date.

THE ASSUMPTIONS UNDERLYING THE 1978 MODELS

Modifications in the 1978 Models

The new models prepared this spring are modifications of the 1976 models. The methodology is essentially the same. The base data for 1953 are unchanged,[106] but several changes have been made in the assumptions for later years for both the low and the high models. In the low model, a control total of 930 million is assumed for midyear 1976, more than 30 million above the previous midyear 1976 figure. This assumption raises the level of all previous totals back to 1955. It is also possible with a very minor adjustment to force the January 1, 1958 figure to agree with the official total of 646,530,000 for that date given by the State Statistical Bureau.[107]

Another change which affects both the low and the high models is in the assumptions about mortality during the food crisis of the early 1960's. In the 1976 models, the low model was also the model in which the effects of the crisis were most severely felt, although in other years the low model was the one with the lowest mortality levels. In the 1978 models, the low model is assumed to be the one in which mortality is least affected by undernutrition during the crisis years, whereas the high model now suffers the most severe mortality and therefore the greatest reduction in natural increase during these years. Because of this change and the higher growth rates for most years in the 1978 low model, the difference in population size between the high and low models is not as great in the 1978 as in the 1976 series.

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[105] Ronald Freedman, "Some Figures and Observations on Vital Rates and on Birth Planning, Obtained in China on Visit, Feb. 10–27, 1976," Mar. 15, 1976, p. 2. The figures given were a national death rate of 7, a rural increase rate of 20 and an urban increase rate of 10. No reference date was specified.

[106] A very minor program change results in a slightly lower total for midyear 1953 and a small difference in the components of change that does not affect the vital rates. The total for Jan. 1, 1954, is also slightly lower than in the 1976 model.

[107] State Statistical Bureau, *loc. cit.*

The Tangshan Earthquake

The number of deaths attributable directly or indirectly to the Tangshan earthquake is not known. In the spring of 1977 Agence France Presse dispatches from Peking stated that "it is believed" that the July 28 quake killed 600,000 people and the November aftershock another 10,000.[108] One of the major dangers following such a severe earthquake is the breakdown of sanitary conditions and the possible outbreak of infectious diseases. More than a year after the first Tangshan quake, the New China News Agency was congratulating "earthquake heroes" who had fought the outbreak of epidemics successfully in spite of "the serious damage to health facilities, contamination of water resources and environment, summer heat and heavy rainfall" which "created a breeding ground for all kinds of plagues." Some 16 million people in the "Tangshan area" were reportedly injected with vaccines to prevent epidemic diseases, but after more than a year work was still under way to restore wells, sewers, and latrines to the condition that had maintained prior to the quake.[109] Despite the claims of success, which had already been attributed to Chairman Hua by the fall of 1976,[110] it is likely that higher general mortality levels prevailed in the areas most severely affected by the quake during the remainder of 1976.

There is no way of estimating the actual loss of life that resulted from the Tangshan earthquake and the ensuing health problems. Without any indication as to how the figures for directly caused fatalities were arrived at, it is impossible to say whether they would have tended to exaggerate or understate the actual toll. To the extent that they were based on Chinese sources, the presumption would be that understatement was more likely. Deaths resulting indirectly from the quake during the remainder of the year would probably not have been attributed to it and therefore would have been left out of the calculations of the overall toll.

In the new series of estimates and projections, an extra 610,000 deaths was included in the low model for the second half of 1976. For the high model, the extra death toll was raised to about 1 million. The intermediate model allows for about 805,000 extra deaths.

Effects of the Successional Struggle

The setbacks to the birth control and public health movements during the successional struggle are also difficult to quantify. As has been noted earlier, few of the many dispatches that mention the damage supposedly done by the "gang of four" to the birth control movement have anything to say about specific effects on the birth control campaign. None of those that are carried in Chinese sources cite figures showing rising birth or natural increase rates, nor could they be expected to. The purpose of the citations is to show triumphs in spite of the difficulties blamed on the "gang" so that other units will not become complacent in case their own vital data are moving in the wrong direction. The only known instance of a local unit reporting rising birth rates is the case of Wan-tou Commune, already mentioned;[111] the data for Wan-tou were not reported in domestic news channels but were given to a foreign visitor.

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[108] AFP, Peking, May 12, 1977; FBIS, No. 92, May 12, 1977, pp. K3–4; and Peking, May 13, 1977; FBIS, No. 93, May 13, 1977, p. K1. In August 1976 a Nationalist Chinese intelligence officer disclosed estimates that two-thirds of the 1.6 million residents of Tangshan were either killed or injured in the quake. Initial Nationalist intelligence reports had estimated only 100,000 killed and 900,000 injured. See AFP, Taipei, Aug. 5, 1976 (via AFP, Hong Kong); FBIS, No. 152, Aug. 5, 1976, pp. E2–3.

[109] NCNA, Peking, Aug. 7, 1977; FBIS, No. 156, Aug. 12, 1977, pp. K3–4.

[110] As Premier, Hua Kuo-feng headed a delegation sent by the Central Committee and the State Council to the areas affected by the earthquake early in August. The solicitude of the group was attributed to the "loving concern" of Chairman Mao and the Central Committee. See NCNA, Peking, Aug. 4, 1976; FBIS, No. 152, Aug. 5, 1976, p. E1. On September 1, representatives of earthquake relief workers sent a letter to Chairman Mao attributing the "victory" in earthquake relief to Mao's revolutionary line, the Cultural Revolution, and the movements to criticize Lin Piao, Confucius, and Teng Hsiao-ping. See NCNA, Peking, Sept. 1, 1976; FBIS, No. 174, Sept. 7, 1976, pp. E2–5. By late October Hua Kuo-feng was credited with having given "many important instructions which inspired us in winning one victory after another in the anti-quake struggle and work of rehabilitation." See NCNA (English), Peking, Oct. 25, 1976; FBIS, No. 208, Oct. 27, 1976, p. K1.

Aside from the question of statistical corroboration, it is hard to determine how much significance should be attached to the reports of "sabotage" of the birth control effort. Because of unfavorable trends in age composition and increasing numbers of young people reaching the new ages of eligibility for marriage, by the middle of the 1970's many units would surely have begun to have difficulty in sustaining downward trends in the birth rate without going far beyond the ordinary restrictions on childbearing. Some small units that had taken advantage of normal variations in numbers of births to claim great progress in birth control and be designated advanced units may have needed a politically safe explanation for the rebound in the birth rate in subsequent years. Some units may have experienced rising birth rates because of improvements in birth records after the establishment of local birth control committees. The convenience of blaming the "gang" for anything that went wrong or was potentially embarrassing would have been as apparent to the local as it was to the national leaders.

Nevertheless, given the fact that constant pressure is apparently required to get local leaders to attach priority to the program and the fact that they must bring pressure to bear on their cadres and on the population to get results, it is altogether plausible that a political disturbance of such magnitude as the successional struggle would have diverted energies from programs that require aggressive administration to make headway either because they were unpopular or because they could not be carried out without mass mobilization. While the outcome of the struggle was uncertain, local cadres in doubt about the future and their own chances of political survival could not be expected to engage in the single-minded pursuit of objectives assigned before the struggle began.

It is therefore entirely plausible that the birth control effort languished during 1976 and perhaps earlier and that a resurgence of birth rates occurred in many units in which the campaign had gained a measure of success against popular opposition. The case of Wan-tou Commune may have been far from unique. But a single case does not provide a basis for estimating the effects of the setback on a national scale. The 20 to 30 percent rise in the birth rate reported for Wan-tou Commune cannot be generalized to other advanced units, let alone to the rest of the country. Moreover, if the maximum impact of succession on birth planning was felt in 1976, the maximum impact on birth rates should have been experienced in 1977. The reaffirmation of support for birth control was not made public until late in 1976, after the consolidation of Hua's power was well under way.

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[111] See p. 448.

In the new estimates and projections it was assumed that the effects of the political disturbances on the birth control program were greater for the low than for the high model because the low model is the one which assumes the greatest success in reducing birth rates. The trend in intrinsic fertility levels continues downward in all models through 1975, turns upward slightly in 1976, reaches a small peak in 1977, then falls rapidly in 1978 to a level below that reached in 1975. The effect on the crude birth rate is a rise between 1975 and 1977 of a little over 12 percent in the low model and 5 percent in the high model.

After 1977 all models assume a sharp drop in fertility in response to the intensification of family planning efforts since August 1977. The low model assumes a decelerating decline in the gross reproduction rate after 1978 until a level of 100 is reached in 1988, 10 years hence, after which the gross reproduction rate remains constant. The high model shows the same basic pattern but at a higher level, reaching a constant gross reproduction rate of 150 in 1988.

Evidence relating to the impact of the successional struggle on health is conflicting. PRC sources claim that the health services were damaged by the "gang" but they also insist that the damage was speedily repaired. Some foreign sources reported that there were local outbreaks of meningitis, hepatitis, and other infectious diseases in various areas in 1976. An unusual emphasis on health programs in the spring of 1977 was thought to be an effort to regain ground lost during 1976.[112] How serious the health situation actually became in 1976 is not easily judged. There would seem on the surface to be no reason why personnel involved in health services should be greatly distracted by the possibility of a change in administrative personnel, since it is unlikely that any leadership group that might take command would oppose health, which surely has no enemies. Yet it is apparent from the dispatches on the annual health and sanitation drives throughout the 1970's that the campaign has required strong central initiatives to get the local political leaders to devote their time and energies to implementation. The mass sanitation projects, which require extensive mobilization of the population, seem to have encountered a great deal of resistance from workers and cadres alike. Policies requiring medical workers and doctors to serve in rural areas and engage part-time in political activities may also have lapsed during the successional struggle, but the effect on mortality levels is uncertain. In general, apart from the Tangshan disaster, there seems to be little reason to suppose that a sharp rise in mortality took place throughout the country in 1976, in spite of the claims of "sabotage" in health work, but it is quite possible that progress toward lower mortality levels was halted for a short time.

In the new models, mortality rises in 1976, mainly due to the Tangshan deaths, but partly also to an assumption that the secular trend toward lower mortality in the country as a whole was interrupted temporarily because of the political disturbances. The combined effects result in a reduction in expectation of life at birth of almost a year in the low model and almost 2 years in the high model. After

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[112] Jay Mathews, "Epidemics Follow Peking's Political Turmoil," *The Washington Post*, May 17, 1977.

1976, the downward trend in mortality resumes immediately and continues to the end of the century, the low model reaching a male expectation of life at birth of 70 years and the high model 60 years in the year 2000. These levels reflect an assumption that, even by the end of the century, the PRC will still not have achieved standards of health care and general living conditions that are fully comparable with those of the more developed countries in the world at the present time.

Once again, the intermediate model assumes intrinsic fertility and mortality levels midway between those of the low and high models.

RESULTS OF THE NEW ESTIMATES AND PROJECTIONS

The three model population estimates and projections that are presented in summary form in tables 1 through 4 are meant to suggest the range within which demographic reality in China probably lies, assuming for the sake of convenience that the 1953 census population total was correct. However, there are reasons for believing that the actual population in 1953 was significantly larger than the census figure, which probably undercounted the population by at least 5 percent. Some of the vital rates for various years from 1953 to 1977 may have been above or below the limits indicated by these models. The data and information available do not permit absolute certainty at any point. There is no basis for confident assertion that the middle of the range is the most likely value for any of the dimensions of the population. Data and information made public in the future may require major reassessments and the construction of new models that differ considerably from those provided here. Such changes have been necessitated in the past.

The Three Models

The low model incorporates both the 1953 census total and the State Statistical Bureau's yearend 1957 figure and reaches a control total by midyear 1976 that is meant to represent the minimal level of official estimates prepared in Peking on the basis of current provincial population totals or assumed annual growth rates since the late 1950's. However, it should not be regarded as an "official data" model. The birth and death rates for the 1950's in the low model are well above those estimated by the State Statistical Bureau of those years. For the middle 1970's the death rates in this model are several points higher than the rumored national death rate and the natural increase rates several points lower. The model does not show natural increase rates below 10 per 1,000 by 1980, despite the official target figure, but then, by 1980 the official estimates may not claim such a low natural increase rate either. It is quite possible that the official estimate of the total population is higher as of yearend 1977 by 20 or 30 million. There is also a possibility, although it seems slight, that the actual current population of the PRC is below the estimates made in Peking and the low model figures.

The high model does not represent a total rejection of claims by the PRC authorities to have made significant progress in birth control and health. It does, however, take a "conservative" approach to them. It does not accept demographic miracles in the absence of reliable evidence, but it shows substantial progress in the control of fertility within the next 10 years. A gross reproduction rate of 150 in 1988 is a considerable reduction from the gross reproduction rate of 299 in 1953. The high model shows steady progress in the reduction of mortality through most of the span of years from 1953 through 2000, but the changes are not spectacular except for the rebound after the food crisis of the early 1960's.

The intermediate model is not to be taken as a "best guess" model, since it was not based on the most probable values for all determinants but incoporates the means of the values assumed for the other two models. It is a compromise model that splits the difference between the low and the high models. Still, if the other two models represent reasonable assumptions about the range of possibilities, the intermediate model should be roughly equivalent to a "best guess" model.

Magnitudes and Range

Absolute population totals for the three models as of January 1 and July 1 for the years 1953–80 and every fifth year to the end of the century are given in table 1. Perhaps the most striking implication of these figures is that China's population is close to or may already have surpassed the 1 billion mark. The low model reaches 1 billion in 1980, the high model exceeds that figure by 1977, and the intermediate model crosses the line by the beginning of May 1978. The total of 900 million, now at last authorized for domestic use in China, should have been passed at least by the middle of 1974 and possibly as early as the end of 1971.

TABLE 1.—TOTAL POPULATION FIGURES, ALTERNATE MODELS, SELECTED YEARS: 1953–2000

[In thousands]

Year	Jan. 1			July 1		
	Low model	Intermediate model	High model	Low model	Intermediate model	High model
1953	576,049	576,049	576,049	582,603	582,603	582,603
1954	589,150	589,150	589,150	596,015	596,035	596,060
1955	602,879	602,920	602,970	610,006	610,220	610,440
1956	617,133	617,519	617,909	624,559	625,112	625,669
1957	631,985	632,704	633,428	639,258	640,247	641,239
1958	646,530	647,790	649,050	653,500	655,184	656,865
1959	660,469	662,577	664,680	667,064	669,727	672,385
1960	673,659	676,876	680,090	680,019	683,075	686,019
1961	686,378	689,274	691,947	692,436	694,590	696,269
1962	698,493	699,906	700,591	705,405	707,011	707,886
1963	712,316	714,115	715,180	719,510	721,780	723,309
1964	726,704	729,444	731,438	734,033	737,462	740,139
1965	741,362	745,479	748,839	749,310	754,017	757,933
1966	757,257	762,554	767,026	765,190	771,101	776,148
1967	773,122	779,647	785,270	781,410	788,700	795,047
1968	789,698	797,752	804,823	798,397	807,251	815,078
1969	807,095	816,750	825,332	816,102	826,630	836,018
1970	825,109	836,510	846,703	834,235	846,580	857,627
1971	843,360	856,649	868,550	852,114	866,651	879,667
1972	860,868	876,652	890,783	869,090	886,410	901,935
1973	877,311	896,168	913,086	885,049	905,678	924,193
1974	892,787	915,188	935,300	900,055	924,449	946,354
1975	907,322	933,709	957,408	914,662	943,037	968,486
1976	922,002	952,364	979,564	930,000	962,299	991,150
1977	937,388	971,427	1,001,736	946,716	982,531	1,014,313
1978	956,043	993,635	1,026,889	964,250	1,003,855	1,038,794
1979	972,457	1,014,074	1,050,699	979,922	1,023,608	1,061,959
1980	987,387	1,033,142	1,073,218	994,298	1,042,018	1,083,710
1985	1,051,754	1,114,482	1,168,128	1,057,849	1,121,966	1,176,688
1990	1,113,034	1,190,233	1,255,403	1,119,442	1,198,307	1,264,879
1995	1,179,453	1,275,546	1,357,115	1,186,355	1,284,715	1,368,344
2000	1,248,125	1,369,858	1,475,174	1,254,797	1,379,570	1,487,781

In referring to the absolute totals, it should be borne in mind that these figures include no allowance for net undercount in the 1953 census. Assuming a net undercount of 5 percent, the 1953 midyear total would have been over 613 million instead of 583 million and the intermediate figure for January 1, 1978, would have been 1,046 million instead of 994 million. The margin of undercount might have been higher still, possibly as high as 10 percent. Unless and until there is a fuller revelation about the methodology actually used in the census-taking in the more populous provinces, one cannot be sure that a substantial part of the total count was not based on postulated numbers instead of actual enumeration and therefore subject to errors much greater than are found even in inefficient field counts.

Of course it is possible that the increase rates used in official estimates of population growth since the 1950's are a little too high because of the admitted tendency to under report deaths. If this is the case, the margin of undercount in the official population totals compiled in Peking may actually have declined. For example, assuming that the net undercount in 1953 was 5 percent but that the low model total for midyear 1978 happens to coincide with the actual population as of that date (that is, that the margin of undercount in the low model totals declines to zero by midyear 1978), then the average annual growth rate of the population for the 25-year period would have been 1.83 percent instead of the 2.04 percent implied by the low model figures as given, and the natural increase rates shown for the low model would be, on the average, about 2 points per 1,000 too high. There is no way to assess the likelihood that the officially estimated growth rates were too high, but in the 1950's the error seemed to be in the other direction, and the chances are that the same tendency persisted in subsequent years and particularly since the intensification of the birth control drive in the early 1970's.

The range of the current population totals in the new models is less than that of the previous models. The latter had a span of 119 million as of midyear 1978 (without allowance for undercount); in the new models the span is 75 million. The reduction is due mainly to the higher rate of growth in the low model based on the control total derived from the recent provincial population figures. The new demographic information, dubious as it is, has nevertheless reduced somewhat the degree of uncertainty about the size of China's population.

By the end of the century, the new models show a total population of from 1¼ to 1½ billion people. The projections from 1978 onward assume no major catastrophies or other startling changes in fertility or mortality. Up to now, China's demographic determinants have not shown such a high degree of stability. There have been setbacks from time to time in the efforts to control both fertility and mortality which have been significant enough to affect national levels. There is no reason to suppose, as has often been mistakenly supposed in the past, that the course of Chinese history hereafter will be all smooth sailing. The projections of population growth during the remainder of the century are therefore not predictions but simply the implications of some rather artificial assumptions. They serve mainly to indicate the orders of magnitude that would be generated given certain hypothetical trends in fertility and mortality.

Vital Rates

The vital rates for the three models for 1953–80 and every 5th year to the end of the century are given in table 2. The trends in vital rates up to the present were part of the input assumptions and have already been discussed. Future birth rates reflect the interaction of age composition with intrinsic rates that show a steady and sharp decline during the next 10 years and constant rates thereafter. Age composition tends during most of these years to push the birth rate upward, and, between 1985 and 1990, its force is more than enough in all models to compensate for the decline in the gross reproduction rate, By the end of the century the effects of age composition begin to turn in the other direction in the low and intermediate models. Even at the lowest point reached in the low model, the birth rate is still not as low as the levels already reached in some of the urbanized, industrialized countries of the West.

TABLE 2.—VITAL RATES, ALTERNATE MODELS, SELECTED YEARS: 1953–2000

Year	Low model			Intermediate model			High model		
	Birth rate	Death rate	Natural increase rate	Birth rate	Death rate	Natural increase rate	Birth rate	Death rate	Natural increase rate
1953	45.0	22.5	22.5	45.0	22.5	22.5	45.0	22.5	22.5
1954	43.8	20.8	23.0	44.1	21.0	23.1	44.5	21.3	23.2
1955	42.8	19.4	23.4	43.3	19.4	23.9	43.9	19.4	24.5
1956	42.1	18.3	23.8	42.8	18.5	24.3	43.5	18.7	24.8
1957	40.7	17.9	22.8	41.6	18.1	23.6	42.5	18.2	24.4
1958	39.6	18.3	21.3	40.6	18.1	22.6	41.7	17.9	23.8
1959	38.7	18.9	19.8	40.2	18.8	21.4	41.7	18.8	22.9
1960	38.0	19.3	18.7	39.8	21.7	18.2	41.7	24.4	17.3
1961	38.0	20.5	17.5	39.7	24.4	15.3	41.4	29.0	12.4
1962	37.6	18.0	19.6	38.9	18.8	20.1	40.2	19.6	20.6
1963	37.0	17.0	20.0	38.6	17.4	21.2	40.2	17.7	22.5
1964	35.6	15.6	20.0	37.7	16.0	21.7	39.9	16.4	23.5
1965	34.7	13.5	21.2	37.0	14.4	22.6	39.4	15.4	24.0
1966	34.3	13.6	20.7	36.8	14.6	22.2	39.2	15.7	23.5
1967	34.1	12.9	21.2	36.7	13.8	23.0	39.3	14.7	24.6
1968	34.3	12.5	21.8	37.0	13.4	23.5	39.6	14.4	25.2
1969	34.0	11.9	22.1	36.9	13.0	23.9	39.7	14.1	25.6
1970	32.9	11.0	21.9	36.1	12.4	23.8	39.3	13.8	25.5
1971	30.8	10.3	20.5	34.9	11.8	23.1	38.8	13.5	25.3
1972	28.7	9.8	18.9	33.4	11.3	22.0	37.9	13.1	24.7
1973	26.9	9.4	17.5	32.0	11.0	21.0	36.8	12.8	24.0
1974	25.0	8.9	16.1	30.5	10.5	20.0	35.7	12.4	23.4
1975	24.5	8.5	16.0	29.9	10.1	19.8	34.9	12.1	22.4
1976	25.5	9.0	16.5	30.7	10.9	19.8	35.5	13.2	22.9
1977	27.5	7.8	19.7	32.3	9.7	22.6	36.8	12.0	24.8
1978	24.5	7.5	17.0	29.7	9.3	20.4	34.6	11.7	22.9
1979	22.4	7.2	15.2	27.6	9.0	18.6	32.5	11.3	21.2
1980	20.8	6.9	13.9	25.8	8.7	17.0	30.3	10.9	19.4
1985	18.0	6.5	11.5	21.3	8.0	13.3	24.3	9.8	14.5
1990	18.0	6.5	11.4	21.3	7.8	13.5	24.5	9.5	15.0
1995	18.3	6.7	11.6	22.2	7.9	14.3	25.9	9.5	16.4
2000	17.6	7.0	10.6	22.1	8.1	14.1	26.5	9.6	16.9

The death rates decline steadily until the 1990's, when the aging of the population more than offsets the continuing slow decline in intrinsic mortality levels. Thereafter, the death rates begin to rise, particularly in the low model. The combination of birth and death rates means that natural increase never quite reaches the target figure of 10 per 1,000 in any of the models, although it is fairly close to the mark in the low model from 1985 onward. Since the low model assumes a gross reproduction rate at less than replacement level, which means, in effect, that the two-child family objective is oversubscribed, it is very unlikely that the PRC can actually attain a natural increase rate below 10 per 1,000, at least in the immediate future. The target seems to have been set without an adequate understanding of current demographic realities in China—especially age composition, marriage rates, and parity levels—perhaps because of expectations based on the exaggerated and atypical vital data from the model family planning units. Or it is possible that the PRC leaders know the target is unrealistic but are willing to use it anyway in the hope of spurring the local units on to still greater efforts.

Age Composition and Functional Age Groups

Table 3 gives the population in 5-year age groups by sex for selected years. The population at ages 65 and over increases steadily in all models throughout the entire period of the estimates and projections. In 1953 it accounts for 3 percent of the total and by the year 2000 for 5 to 7 percent. But the average age of the population actually declines until about 1965, when falling birth rates finally cause a decline also in the proportion of the population under 15 years of age. Through 1970 about 40 percent of the population is less than 15 years of age, but by the year 2000 the proportion is down to 30 percent in the high model and below 25 percent in the low model. The population at ages 15 through 64, roughly the productive ages, increases in absolute terms in all models from 1953 to 2000, but in relative terms their share of the total declines for about 10 years after 1953 to around 55 percent, then rises until by the year 2000 it is almost 65 percent in the high model and 70 percent in the low model. The prospects are for a proportional reduction in the dependent population of the next 20 years as for the past 15.

TABLE 3.—POPULATION BY 5-YR AGE GROUPS AND SEX, ALTERNATE MODELS, FOR SELECTED YEARS: 1953–2000

[In thousands]

Series and age (years)	1953	1960	1970	1980	1990	2000
LOW MODEL						
Both sexes						
All ages	582, 603	680, 019	834, 235	994, 298	1, 119, 442	1, 254, 797
Under 5	94, 701	107, 626	119, 974	110, 472	93, 867	107, 555
5 to 9	69, 569	94, 601	105, 896	110, 862	93, 312	101, 725
10 to 14	60, 965	74, 521	99, 079	116, 134	109, 147	93, 139
15 to 19	58, 483	61, 341	91, 786	104, 432	110, 101	92, 861
20 to 24	53, 119	57, 039	71, 565	97, 167	114, 984	108, 360
25 to 29	45, 977	53, 055	58, 195	89, 213	103, 008	109, 007
30 to 34	39, 729	46, 015	53, 616	69, 411	95, 610	113, 671
35 to 39	34, 527	39, 497	49, 457	56, 192	87, 753	101, 621
40 to 44	30, 341	33, 734	42, 382	51, 363	67, 747	93, 889
45 to 49	26, 112	29, 248	35, 787	46, 776	54, 266	85, 414
50 to 54	21, 699	24, 892	29, 820	39, 276	48, 719	64, 910
55 to 59	17, 268	20, 267	24, 846	32, 085	43, 131	50, 647
60 to 64	12, 851	15, 562	19, 842	25, 394	34, 636	43, 612
65 to 69	8, 672	10, 939	14, 620	19, 464	26, 321	36, 114
70 to 74	5, 144	6, 761	9, 597	13, 582	18, 468	25, 898
75 and over	3, 448	4, 921	7, 773	12, 265	18, 372	26, 374

TABLE 3.—POPULATION BY 5-YR AGE GROUPS AND SEX, ALTERNATE MODELS, FOR SELECTED YEARS: 1953–2000—Continued

[In thousands]

Series and age (years)	1953	1960	1970	1980	1990	2000
Male						
All ages	294, 487	342, 820	419, 803	499, 896	562, 350	630, 138
Under 5	47, 945	54, 413	60, 888	56, 224	47, 864	54, 885
5 to 9	35, 632	47, 758	53, 530	56, 275	47, 495	51, 847
10 to 14	31, 291	38, 022	50, 042	58, 832	55, 453	47, 426
15 to 19	30, 056	31, 485	46, 365	52, 738	55, 811	47, 209
20 to 24	26, 977	29, 333	36, 514	48, 985	58, 116	54, 939
25 to 29	23, 098	27, 071	29, 835	45, 054	51, 864	55, 110
30 to 34	19, 773	23, 174	27, 528	35, 335	48, 082	57, 319
35 to 39	17, 270	19, 684	25, 184	28, 753	44, 125	51, 072
40 to 44	15, 393	16, 697	21, 246	26, 292	34, 404	47, 115
45 to 49	13, 310	14, 603	17, 657	23, 682	27, 651	42, 798
50 to 54	10, 986	12, 483	14, 507	19, 476	24, 747	32, 745
55 to 59	8, 592	10, 090	12, 101	15, 545	21, 525	25, 479
60 to 64	6, 238	7, 601	9, 623	12, 004	16, 750	21, 651
65 to 69	4, 088	5, 188	6, 971	9, 101	12, 266	17, 384
70 to 74	2, 346	3, 089	4, 435	6, 240	8, 271	11, 896
75 and over	1, 492	2, 129	3, 377	5, 360	7, 926	11, 263
Female						
All ages	288, 113	337, 199	414, 432	494, 402	557, 092	624, 659
Under 5	46, 753	53, 213	59, 086	54, 248	46, 003	52, 670
5 to 9	33, 937	46, 843	52, 366	54, 587	45, 817	49, 878
10 to 14	29, 674	36, 499	49, 037	57, 302	53, 694	45, 713
15 to 19	28, 427	29, 856	45, 421	51, 694	54, 290	45, 652
20 to 24	26, 142	27, 706	35, 051	48, 182	56, 868	53, 421
25 to 29	22, 879	25, 984	28, 360	44, 369	51, 144	53, 897
30 to 34	19, 956	22, 841	26, 088	34, 076	47, 528	56, 352
35 to 39	17, 257	19, 813	24, 273	27, 439	43, 628	50, 549
40 to 44	14, 948	17, 037	21, 136	25, 071	33, 343	46, 774
45 to 49	12, 801	14, 645	18, 130	23, 094	26, 615	42, 616
50 to 54	10, 713	12, 409	15, 313	19, 800	23, 972	32, 165
55 to 59	8, 676	10, 177	12, 745	16, 540	21, 606	25, 168
60 to 64	6, 613	7, 961	10, 219	13, 390	17, 886	21, 961
65 to 69	4, 583	5, 751	7, 649	10, 363	14, 055	18, 730
70 to 74	2, 798	3, 672	5, 162	7, 342	10, 197	14, 002
75 and over	1, 956	2, 792	4, 396	6, 905	10, 446	15, 111
INTERMEDIATE MODEL						
Both sexes						
All ages	582, 603	683, 075	846, 580	1, 042, 018	1, 198, 307	1, 379, 570
Under 5	94, 701	110, 630	129, 502	135, 514	115, 300	141, 346
5 to 9	69, 569	94, 811	109, 689	129, 068	115, 117	127, 220
10 to 14	60, 965	74, 503	100, 798	124, 200	132, 338	113, 354
15 to 19	58, 483	61, 326	91, 751	107, 686	127, 515	114, 038
20 to 24	53, 119	57, 026	71, 319	98, 265	122, 095	130, 536
25 to 29	45, 977	53, 040	57, 947	88, 715	105, 237	125, 164
30 to 34	39, 729	46, 000	53, 348	68, 575	95, 665	119, 502
35 to 39	34, 527	39, 486	49, 178	55, 402	86, 024	102, 654
40 to 44	30, 341	33, 725	42, 119	50, 549	66, 022	92, 712
45 to 49	26, 111	29, 242	35, 547	45, 948	52, 680	82, 438
50 to 54	21, 699	24, 880	29, 607	38, 496	47, 087	62, 063
55 to 59	17, 268	10, 259	24, 640	31, 372	41, 454	48, 003
60 to 64	12, 851	15, 552	19, 641	24, 724	33, 034	40, 853
65 to 69	8, 671	20, 930	14, 435	18, 829	24, 840	33, 296
70 to 74	5, 144	6, 749	9, 443	13, 023	17, 168	23, 382
75 and over	3, 448	4, 916	7, 616	11, 652	16, 731	23, 009

3.—POPULATION BY 5-YR AGE GROUPS AND SEX, ALTERNATE MODELS, FOR SELECTED YEARS 1953–2000—Continued

[In thousands]

Series and age (years)	1953	1960	1970	1980	1990	2000
Male						
All ages	294, 487	344, 360	426, 008	523, 982	602, 135	692, 949
Under 5	47, 945	55, 928	65, 701	68, 882	58, 686	71, 986
5 to 9	35, 632	47, 863	55, 415	65, 464	58, 489	64, 694
10 to 14	31, 291	38, 013	50, 911	62, 912	67, 149	57, 591
15 to 19	30, 056	31, 477	46, 362	54, 369	64, 601	57, 862
20 to 24	26, 977	29, 324	36, 398	49, 560	61, 720	66, 089
25 to 29	23, 098	27, 065	29, 711	44, 723	52, 988	63, 234
30 to 34	19, 773	23, 165	27, 392	34, 924	48, 139	60, 271
35 to 39	17, 270	19, 682	25, 046	28, 350	43, 279	51, 586
40 to 44	15, 393	16, 693	21, 106	25, 861	33, 525	46, 527
45 to 49	13, 310	14, 599	17, 528	23, 234	26, 813	41, 275
50 to 54	10, 986	12, 474	14, 388	19, 050	23, 855	31, 241
55 to 59	8, 592	10, 085	11, 988	15, 162	20, 612	24, 057
60 to 64	6, 238	7, 598	9, 517	11, 655	15, 905	20, 168
65 to 69	4, 088	5, 183	6, 877	8, 781	11, 527	15, 930
70 to 74	2, 346	3, 084	4, 362	5, 971	7, 656	10, 673
75 and over	1, 492	2, 127	3, 306	5, 084	7, 191	9, 765
Female						
All ages	288, 113	338, 715	420, 572	518, 036	596, 172	686, 621
Under 5	46, 753	54, 702	63, 801	66, 632	56, 614	69, 360
5 to 9	33, 937	46, 948	54, 274	63, 604	56, 628	62, 526
10 to 14	29, 674	36, 490	49, 887	61, 288	65, 189	55, 763
15 to 19	28, 427	29, 849	45, 389	53, 317	62, 914	56, 176
20 to 24	26, 142	27, 702	34, 921	48, 705	60, 375	64, 447
25 to 29	22, 879	25, 975	28, 236	43, 992	52, 249	61, 930
30 to 34	19, 956	22, 835	25, 956	33, 651	47, 526	59, 231
35 to 39	17, 257	19, 804	24, 132	27, 052	42, 745	51, 068
40 to 44	14, 948	17, 032	21, 013	24, 688	32, 497	45, 185
45 to 49	12, 801	14, 643	18, 019	22, 714	25, 867	41, 163
50 to 54	10, 713	12, 406	15, 219	19, 446	23, 232	30, 822
55 to 59	8, 676	10, 174	12, 652	16, 210	20, 842	23, 946
60 to 64	6, 613	7, 954	10, 124	13, 069	17, 129	20, 685
65 to 69	4, 583	5, 747	7, 558	10, 048	13, 313	17, 366
70 to 74	2, 798	3, 665	5, 081	7, 052	9, 512	12, 709
75 and over	1, 956	2, 789	4, 310	6, 568	9, 540	13, 244
HIGH MODEL						
Both sexes						
All ages	582, 603	686, 019	857, 627	1, 083, 710	1, 264, 879	1, 487, 781
Under 5	94, 701	113, 550	138, 611	158, 262	134, 736	174, 322
5 to 9	69, 569	95, 040	113, 081	145, 435	133, 881	150, 133
10 to 14	60, 965	74, 483	102, 258	131, 567	152, 386	130, 666
15 to 19	58, 483	61, 322	91, 710	110, 462	142, 810	131, 835
20 to 24	53, 119	57, 009	71, 050	99, 027	128, 302	149, 139
25 to 29	45, 977	53, 021	57, 696	87, 952	106, 849	138, 791
30 to 34	39, 729	45, 988	53, 064	67, 667	95, 257	124, 124
35 to 39	34, 527	39, 471	48, 886	54, 571	84, 143	102, 874
40 to 44	30, 341	33, 711	41, 835	49, 670	64, 165	90, 954
45 to 49	26, 111	29, 223	35, 282	45, 081	51, 025	79, 314
50 to 54	21, 699	24, 862	29, 365	37, 689	45, 403	59, 201
55 to 59	17, 268	20, 241	24, 411	30, 623	39, 787	45, 481
60 to 64	12, 851	15, 533	19, 421	24, 031	31, 484	38, 343
65 to 69	8, 671	10, 917	14, 235	18, 173	23, 425	30, 873
70 to 74	5, 144	6, 742	9, 276	12, 464	15, 971	21, 323
75 and over	3, 448	4, 906	7, 446	11, 036	15, 255	20, 408

E 3.—POPULATION BY 5-YR AGE GROUPS AND SEX, ALTERNATE MODELS, FOR SELECTED YEARS: 1953–2000—Continued

[In thousands]

Series and age (years)	1953	1960	1970	1980	1990	2000
Male						
All ages	294, 487	345, 836	431, 557	545, 059	635, 745	747, 490
Under 5	47, 945	57, 399	70, 301	80, 346	68, 479	88, 648
5 to 9	35, 632	47, 977	57, 095	73, 722	67, 926	76, 232
10 to 14	31, 291	38, 006	51, 648	66, 649	77, 247	66, 299
15 to 19	30, 056	31, 475	46, 351	55, 767	72, 341	66, 830
20 to 24	26, 977	29, 316	36, 277	49, 970	64, 894	75, 464
25 to 29	23, 098	27, 053	29, 592	44, 365	53, 811	70, 121
30 to 34	19, 773	23, 157	27, 247	34, 487	47, 965	62, 636
35 to 39	17, 270	19, 673	24, 893	27, 934	42, 358	51, 700
40 to 44	15, 393	16, 685	20, 957	25, 400	32, 586	45, 639
45 to 49	13, 310	14, 588	17, 387	22, 762	25, 934	39, 666
50 to 54	10, 986	12, 462	14, 256	18, 610	22, 935	29, 731
55 to 59	8, 592	10, 076	11, 862	14, 763	19, 703	22, 704
60 to 64	6, 238	7, 587	9, 399	11, 303	15, 095	18, 833
65 to 69	4, 088	5, 178	6, 777	8, 461	10, 829	14, 685
70 to 74	2, 346	3, 082	4, 283	5, 707	7, 101	9, 679
75 and over	1, 492	2, 122	3, 232	4, 813	6, 541	8, 623
Female						
All ages	288, 113	340, 183	426, 070	538, 651	629, 134	740, 291
Under 5	46, 753	56, 151	68, 310	77, 916	66, 257	85, 674
5 to 9	33, 937	47, 063	55, 986	71, 713	65, 955	73, 901
10 to 14	29, 674	36, 477	50, 610	64, 918	75, 139	64, 367
15 to 19	28, 427	29, 847	45, 359	54, 695	70, 469	65, 005
20 to 24	26, 142	27, 693	34, 773	49, 057	63, 408	73, 675
25 to 29	22, 879	25, 968	28, 104	43, 587	53, 038	68, 670
30 to 34	19, 956	22, 831	25, 817	33, 180	47, 292	61, 488
35 to 39	17, 257	19, 798	23, 993	26, 637	41, 785	51, 174
40 to 44	14, 948	17, 026	20, 878	24, 270	31, 579	45, 315
45 to 49	12, 801	14, 635	17, 895	22, 319	25, 091	39, 648
50 to 54	10, 713	12, 400	15, 109	19, 079	22, 468	29, 478
55 to 59	8, 676	10, 165	12, 549	15, 860	20, 084	22, 777
60 to 64	6, 613	7, 946	10, 022	12, 728	16, 389	19, 510
65 to 69	4, 584	5, 739	7, 458	9, 712	12, 596	16, 188
70 to 74	2, 798	3, 660	4, 993	6, 757	8, 870	11, 644
75 and over	1, 956	2, 784	4, 214	6, 223	8, 714	11, 785

Absolute population totals by sex for other significant age groups are given for selected years in table 4. The preschool and school ages as shown in this table are not the same as those that have been used in China up to now, but are taken from the new "Draft Plan for a Ten-Year Full-Time Teaching System for Primary and Middle Schools" recently promulgated by the Ministry of Education.[113] The system is not yet fully in effect and can only be phased in gradually because it advances the age of admission to elementary school by 1 year and that for senior middle school by 3 years. This means that the schools must absorb extra incoming students at the new lower age levels while still retaining students who entered under the previous system and have not completed their courses of studies. The transition will be somewhat easier at the elementary level because of the declining size of the entering cohorts.

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[113] "New Teaching System for Primary and Middle Schools," *Peking Review*, No. 8, Feb. 24, 1978, p. 15.

TABLE 4.—POPULATION IN FUNCTIONAL AGE GROUPS, ALTERNATE MODELS, FOR SELECTED YEARS: 1953–2000

[In thousands]

Age group	1953	1960	1970	1980	1990	2000
LOW MODEL						
Both sexes:						
Preschool ages	109, 827	127, 859	141, 941	131, 144	112, 168	128, 566
School ages	127, 250	161, 852	202, 583	227, 975	204, 693	192, 072
Primary	67, 000	90, 974	103, 652	114, 524	95, 182	99, 934
Junior middle	36, 467	44, 414	59, 474	69, 786	67, 774	55, 684
Senior middle	23, 783	26, 464	39, 457	43, 665	41, 737	36, 454
Working ages	310, 062	345, 880	430, 015	554, 153	691, 496	787, 015
Retirement ages	35, 461	44, 429	59, 696	81, 026	111, 085	147, 144
Male:						
Preschool ages	55, 692	64, 625	72, 016	66, 726	57, 186	65, 598
School ages	65, 268	82, 216	102, 328	114, 463	104, 046	97, 831
Primary	34, 323	45, 939	52, 354	58, 110	48, 429	50, 925
Junior middle	18, 716	22, 706	30, 044	35, 350	34, 436	28, 354
Senior middle	12, 229	13, 571	19, 930	22, 103	21, 181	18, 552
Prime military ages	28, 514	29, 874	40, 387	49, 599	59, 494	51, 964
Working ages	160, 794	179, 691	223, 184	287, 562	359, 654	409, 109
Retirement ages	12, 733	16, 288	22, 275	30, 045	41, 464	57, 600
Female:						
Preschool ages	54, 135	63, 234	69, 925	64, 418	54, 982	62, 968
School ages	61, 982	79, 636	100, 255	112, 412	100, 647	94, 241
Primary	32, 677	45, 035	51, 298	56, 414	46, 753	49, 009
Junior middle	17, 751	21, 708	29, 430	34, 436	33, 338	27, 330
Senior middle	11, 554	12, 893	19, 527	21, 562	20, 556	17, 902
Prime fertility ages	56, 551	63, 978	72, 372	103, 616	129, 808	142, 407
Working ages	149, 268	166, 189	206, 831	266, 591	331, 842	377, 906
Retirement ages	22, 728	28, 140	37, 421	50, 981	69, 621	89, 544
INTERMEDIATE MODEL						
Both sexes:						
Preschool ages	109, 827	131, 048	152, 740	160, 745	137, 618	168, 013
School ages	127, 250	161, 857	206, 934	250, 838	250, 065	236, 022
Primary	67, 000	90, 994	106, 610	139, 165	117, 943	124, 143
Junior middle	36, 467	44, 404	60, 561	74, 579	81, 591	67, 711
Senior middle	23, 783	26, 459	39, 763	46, 094	50, 531	44, 168
Working ages	310, 062	345, 780	427, 958	552, 077	736, 000	840, 532
Retirement ages	35, 461	44, 390	58, 948	78, 358	104, 624	135, 003
Male:						
Preschool ages	55, 692	66, 233	77, 471	81, 687	70, 031	85, 552
School ages	65, 268	82, 218	104, 499	127, 113	126, 931	119, 947
Primary	34, 323	45, 948	53, 808	66, 001	59, 910	63, 118
Junior middle	18, 716	22, 702	30, 601	37, 776	41, 402	34, 402
Senior middle	12, 229	13, 568	20, 090	23, 336	25, 619	22, 427
Prime military ages	28, 514	29, 865	40, 279	50, 330	64, 611	63, 529
Working ages	160, 794	179, 636	222, 085	286, 279	366, 467	435, 216
Retirement ages	12, 733	16, 273	21, 953	28, 903	38, 706	52, 234
Female:						
Preschool ages	54, 135	64, 815	75, 269	79, 058	67, 587	82, 461
School ages	61, 982	79, 639	102, 435	123, 725	123, 134	116, 075
Primary	32, 677	45, 046	52, 802	64, 164	58, 033	61, 025
Junior middle	17, 751	21, 702	29, 960	36, 803	40, 189	33, 309
Senior middle	11, 554	12, 891	19, 673	22, 758	24, 912	21, 741
Prime fertility ages	56, 551	63, 960	72, 038	102, 826	131, 934	157, 776
Working ages	149, 268	166, 144	205, 873	265, 798	369, 533	405, 316
Retirement ages	22, 728	28, 117	36, 995	49, 455	65, 918	82, 769
HIGH MODEL						
Both sexes:						
Preschool ages	109, 827	134, 162	163, 058	187, 578	160, 509	206, 182
School ages	127, 250	161, 871	210, 685	271, 551	289, 273	274, 320
Primary	67, 000	91, 025	109, 122	144, 245	137, 566	145, 674
Junior middle	36, 467	44, 391	61, 516	78, 970	93, 500	77, 999
Senior middle	23, 783	26, 455	40, 047	48, 336	58, 207	50, 647
Working ages	310, 062	345, 651	425, 751	548, 954	716, 541	882, 527
Retirement ages	35, 461	44, 335	58, 133	75, 627	98, 556	124, 752
Male:						
Preschool ages	55, 692	67, 802	82, 683	95, 212	81, 560	104, 831
School ages	65, 268	82, 226	106, 360	137, 591	146, 676	139, 220
Primary	34, 323	45, 963	55, 029	73, 107	69, 783	73, 956
Junior middle	18, 716	22, 697	31, 093	40, 005	47, 398	39, 576
Senior middle	12, 229	13, 566	20, 238	24, 479	29, 495	25, 688
Prime military ages	28, 514	29, 861	40, 167	50, 800	69, 111	73, 269
Working ages	160, 794	179, 556	220, 908	284, 487	371, 343	455, 653
Retirement ages	12, 733	16, 252	21, 606	27, 769	36, 166	47, 786

TABLE 4.—POPULATION IN FUNCTIONAL AGE GROUPS, ALTERNATE MODELS, FOR SELECTED YEARS: 1953–2000—Continued

[In thousands]

Age group	1953	1960	1970	1980	1990	2000
Female:						
Preschool ages	54, 135	66, 360	80, 375	92, 366	78, 949	101, 351
School ages	61, 982	79, 645	104, 325	133, 960	142, 597	135, 100
Primary	32, 677	45, 062	54, 093	71, 138	67, 783	71, 718
Junior middle	17, 751	21, 694	30, 423	38, 965	46, 102	38, 423
Senior middle	11, 554	12, 889	19, 809	23, 857	28, 712	24, 959
Prime fertility ages	56, 551	63, 944	71, 682	101, 911	133, 342	170, 456
Working ages	149, 268	166, 095	204, 843	264, 467	345, 198	426, 874
Retirement ages	22, 728	28, 083	36, 527	47, 858	62, 390	76, 966

The new 10-year system replaces a 12-year system that consisted of 6 years of elementary and 3 years each of junior and senior middle school. In theory at least, students entered elementary school at age 7 and completed senior middle school at age 18, although in fact some students entered the system at a later age and some did not complete middle school. Under the new system, students would enter at age 6 and graduate from senior middle school at age 15; elementary and junior middle school programs are each shortened by 1 year. Advancing the age for elementary school reduces by 1 year the span of the preschool ages.

According to the low model, the numbers of children of elementary school age increase until 1977, decline somewhat irregularly until 1993, and then rise gradually until the end of the century. According to the high model, their numbers rise until 1985, decline until 1993, then rise again through the year 2000. In the middle schools, a similar pattern appears but with a delay of 5 years. The total population of school age in China is shown as 127 million as of 1953 in all models but rises to 228 million in the low model and 272 in the high by 1980 and to 192 and 274 million, respectively, in the year 2000. The wide range of 82 million by the end of the century, plus or minus 17 percent around the intermediate model figure of 236 million, indicates the importance of success in birth control for the scale of educational services that will be required in the future.

The working age population is assumed to include the same ages that were so designated by PRC labor force specialists in the 1950's—ages 16 to 50 years for males and 16 to 55 years for females. In all models, the population in the working ages increases from 1953 through the end of the century. In 1953 all models show a working age population of 310 million. By the year 2000, the low model projects a total of 787 million and the high model 883 million, a range of only plus or minus 7 percent around the intermediate model total of 840 million.

The population in the retirement ages consists of men aged 61 and over and women aged 56 and over. Their numbers increase from 35 million in 1953 to 147 million in the low model and 125 in the high model by the year 2000. Although the low figure implies more than a tripling of their numbers in the 47-year period, they still constitute a relatively small burden on the massive population of working ages, but their numbers are rising rapidly as the century ends. The dependency burden will be much greater in the 21st century.

The numbers of males in the prime military ages, ages 18 to 22 years, do not give the full measure of the military manpower resources of a country that has many relatively young veterans of military service now in civilian life who could be recalled in case of need, a considerable force of militia organized and available for at least paramilitary duty, and a number of young women with military training. The males in the prime military ages alone reach about 50 million in 1980 according to these projections and 52 to 73 million by the year 2000.

What are referred to in table 4 as the "prime fertility ages" for women, ages 23 to 35, begin with the minimum target age at marriage for women in rural areas and end with an age at which, if the two-child per family limit can be made obligatory, most childbearing would be over in both urban and rural areas. The women in these ages are presumably the prime objects of family planning propaganda and the prime candidates for sterilization. In 1953 they are estimated to have totaled only 57 million, but by 1980 their numbers are projected to reach 102 to 104 million and by the year 2000 from 142 to 170 million. The annual incoming cohorts at age 23 are under 10 million in 1980 but increase to 11 to 15 million by 2000.

GENERAL IMPLICATIONS

If China's demographic prospects fall within the range indicated by the low and high model projections presented here, it is obvious that there are significant differences between the two extremes by the year 2000. The size of the totals varies by about 17 percent of the mean value and the annual population growth rates range from 1.1 percent to 1.7 percent. However, either of these rates is sufficient to give continuing cause for concern in a country with finite resources at an early stage of economic development with an already large population. The pressure of population growth on the growth of food production may not be greatly reduced by the anticipated decline in natural increase rates if the expedients used to increase agricultural output yield diminishing returns. Unless the economy is more immune in the future than it has been in the past to political dislocations, population growth will continue to dissipate a significant portion of the gains from economic growth. The difficulties of funding productive employment for large increments to the labor force while mechanizing labor in both the nonagricultural and agricultural sectors will continue without much relief from demographic change before 1990. Hence even the rather spectacular shifts in fertility projected for these models during the next few years do not portend an immediate and radical remission in the problems that have hitherto been posed by population growth in the PRC.

The possibility of radical shifts in demographic prospects cannot be ruled out absolutely. Although the prospect seems highly unlikely, it is not altogether inconceivable that the PRC might be able to achieve a degree of control over civil affairs that would make zero population growth possible in the near future, although it might mean mandating the one-child family or denying parenthood to a large segment of the population for a generation. There is also the possibility of a catastrophic depletion of the population resulting from either a man-made or a natural disaster. The PRC leaders themselves have from time to time entertained the idea of a massive slaughter of their population in a war with the Soviet Union. An acute political upheaval or a deterioration in civil order could disrupt the rural economy enough to bring on a serious famine. Lesser but still demographically significant disturbances have occurred since 1949 as a result of political adventures that miscarried or recurrent adverse weather conditions, and there can be no guarantees that neither will happen again in the future.

However, the extreme possibilities do not seem very likely. The most plausible expectation as to the demographic future of the PRC is for a continuing decline in the rate of population growth in the next decade until a certain minimum level is achieved, after which the population will continue to grow to the end of the century at rates that fluctuate with specific political and social developments that cannot be wholly anticipated and with changes in age composition that are already largely determined.

TECHNOLOGY AND SCIENCE—SOME ISSUES IN CHINA'S MODERNIZATION*

By Jon Sigurdson

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Introduction

The time may be particularly ripe for discussing technology and science in China and the reasons are manifold. The policy debate in China—not limited only to technology and science—which has been raging in China since the First Session of the Fourth National People's Congress in early 1975 has now been settled. Much information on the debate has been available so it is relatively easy to present, in some detail, the issues which have been debated. China is now reorganizing and quickly developing her institutions of technology and science in order to make them better serve the country. In this process China has clearly indicated that increased technological and scientific contacts with other countries and foreign scientists are important. Science and technology is also one of the "four modernizations" where China has set the goal to achieve full modernization before the end of the century so that the national economy will be advancing in the front ranks of the world. This should in no way be interpreted that China is going to develop science and technology for its own sake. The development goals of the country are clearly deciding the priorities and allocations within science and technology, even if many foreign observers may initially have made a different interpretation. Science and technology must meet different needs in the Chinese society and we have been given many indications that advanced science and technology may in the past have been temporarily neglected—a situation which is now being rapidly remedied.

One of the problems in technological development has been the gap between China and advanced countries. The noted scientist Chien Hsueh-sen in 1977 discussed the gap between China's science and technology and the advanced countries of the world.[1] In his views and comments, which are personal, he deals with four questions related to the gap. The first is whether or not there exists a disparity between the level in China's science and technology and advanced world levels. There are some things in China he says, which come close to or which surpass advanced world levels. But they represent only a part of the whole, and a relatively small part at that, and in most cases China is relatively backward. Furthermore, he says, among those scientific and technological undertakings in which we have achieved relatively better successes and have surpassed foreign countries in terms of overall results, the technical level of some of the machinery and equipment is not high.

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*This article is a considerably shortened and more analytical version of a book-length manuscript which is simultaneously being published in England and Sweden ("Technology and Science in the People's Republic of China—An Introduction," Society for Anglo-Chinese Understanding, London 1978, and Bo Cavefors Publishers, Lund 1978). The underlying research has mainly been carried out at the Research Policy Program at the University of Lund, Sweden. The estimates of the R. & D. expenditure is based on collaborative work undertaken together with Boel Billgren. I have also been assisted by Lisbeth Rasmusan who has helped me in building up a systematic collection of documents which directly or indirectly relate to science policy and technological achievements in China.

He then goes on to discuss the second question whether China should gradually narrow the disparity and catch up with and surpass the advanced world levels. The speed and direction have been critical issues and Chien Hsuah-sen's views are not always very illuminating. In essence he says that socialist economic construction and the national defence requires the narrowing of the disparity.

On the third question whether China is able to catch up with and surpass he is equally vague by referring to the superiority of the country's socialist system. He points to the contradiction between the socialization of science and technology and private ownership under the capitalist system—a contradiction which cannot be resolved. Consequently, according to Chien's views, this has placed an obstruction in the path of the development of science and technology in market economies. If we look at the temporary development of science and technology in advanced industrialized countries this can only be partially correct. However, Chien answers the third question in the affirmative and says that, in the final analysis, the interests of the individual, the collective and the State are in accordance with one another in China. If we accept, at least some of, the criticism leveled at the political opponents, the "gang of four," this situation has not been prevailing in China in recent years.

In his final question Chien Hsueh-sen discusses how to bring the superiority of the socialist system into full play and enable China's science and technology to catch up and surpass the advanced world levels. Even here the article lacks specificity but the substance can be seen in the many reforms and measures which have been announced and implemented since the article was published.

The somewhat gloomy views of Chien Hsueh-sen on the present situation are reiterated in a statement by Fang Yi, vice president of the Chinese Academy of Sciences who, at the end of December 1977, says that "China's science and education are in such a state that virtually everything needs to be done." In order to deal with the situation the party central committee and the state council has made a number of major decisions and taken effective measures which are listed here.[2]

1. A state commission of science and technology has been set up. Its responsibilities will be the overall planning, coordination,

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[1] "Science and Technology Must Catch Up With and Surpass Advanced World Levels Before the End of the Century," *Red Flag*, 1977, No. 7, by Chien Hsueh-sen BBC FE/5563/B11/6.

[2] Comrade Fang Yi on heartening progress in China's science and education, Hsinhua News (Stockholm), 1977, No. 314 (Dec. 31). Fang Yi was making a report on the situation in China's science and technology on Dec. 27, 1977, at the seventh session of the standing committee of the fourth national committee of the Chinese people's political consultative conference.

organization and administration of the country's scientific and technological work.

2. A system of directors assuming responsibility in research institutes under the leadership of the party committees has been approved. The leadership of many scientific research institutions and a number of universities and colleges has been reorganized and strengthened.

3. A program for the development of science and technology and that of education is being drafted.

4. The administrative system has been changed in order to make full use of local and central initiatives. Some of scientific research institutions which were transferred or discharged have been restored and others are under consideration.

5. Science conferences or teachers' meetings have been held in a number of places to award those with outstanding achievements and to exchange experience. The restoration of titles for technical personnel has been carried out in order to encourage improvement in professional skill, assess technical proficiency and strengthen the system of specific responsibilities.

6. Academic and working conferences have been held to implement the principle of "letting a hundred flowers blossom and a hundred schools contend." The national scientific and technological association has been revived and various scientific societies have resumed their work.

7. A new system for enrolling students in universities and colleges has been implemented and large numbers of promising students have come forward.

8. The compilation of a new set of standard textbooks for the whole country is being carried out under the responsibility of the ministry of education. The principle followed is to condense the teaching material and do everything in order to provide the young people with the latest scientific and technical knowledge.

9. While keeping to the principle of independence and self-reliance China will strive to learn advanced science and technology from foreign countries and promote international academic exchanges.

10. Scientific and technical personnel will be guaranteed at least five-sixths of the week for professional work.

11. Science and education will have their funds, coming from the state budget, appropriately increased in order to accelerate and expand development.

12. Science and education will receive more publicity and more efforts will be made to spread scientific knowledge.

An attempt will be made in the following to relate all these changes to the existing situation and the needs in China. Here we have to remember that China is a country with a still dominant majority of her population and manpower in agriculture. We are also looking at a continental country with manpower resources far exceeding any other country. At the same time China has set up structures in science and technology which on one hand are designed to facilitate her economic development strategy and on the other hand be one of the instruments in moving toward socialism and—in Mao's conception—creating a new man. Consequently, it has been considered necessary to make a fairly detailed presentation of policy issues and the science policy debate in China. However, this is also an attempt to present certain important facts about technological development, the role of technicians and the buildup of institutions.

Frank views on the technology gap were again reiterated when Fang Yi made his general report to the national science conference which convened in Peking in late March and early April 1978. At the time he said that "our country is now lagging 15 to 20 years behind in many branches and more still in some others." [3] In order to deal with the situation a national plan for the development of science and technology 1978–85 had been drafted in December 1977 and January 1978 and was presented to the conference for discussions. The major goals of this plan are: [4]

1. Increase the number of professional research workers to 800,000;
2. Build a number of up-to-date centers for scientific experiment;
3. Complete a nationwide system for scientific and technological research; and
4. Approach or reach advanced world levels of the 1970's in a number of branches of science and technology.

Related to this last goal Vice Premier Teng Hsiao-ping in his opening statement at the conference stressed that:

> It is not just today, when we are scientifically and technically backward, that we need to learn from other countries—after we catch up with advanced world levels in science and technology, we will still have to learn from the strong points of others.[5]

The present interest in collaboration is reflected in comments made by Li Chang at the National Science Conference. He said that the postgraduate school of the university of science and technology and other research institutes will invite outstanding foreign scientists to conduct seminars. Invitations from prominent foreign, and friendly, research institutions will also be accepted so that high level Chinese scientists and technicians can take part in their research projects.[6]

The 8-year plan, 1978–85, gives prominence to eight comprehensive areas of science and technology; namely, energy resources, materials, electronic computers, laser, space science, high energy physics, genetics, and naturally agriculture, and will cover both basic and technical sciences. Included in this approach are 108 items which have been chosen as key projects although not yet been made public. When the plan is fulfilled in 1985 China is, according to Fang Yi, expected to approach or reach the advanced world levels of 1970's in a number of important branches of science and technology with a resulting reduction in the gap to about 10 years.[7]

Similarly, medium-term plans, for 5 and 8 years, have also been drawn up for the Academy of Social Sciences which has been created as a new entity out of the Department of Social Sciences which, until recently, was part of the Academy of Sciences.[8] Organizational measures are also introduced which will help China to develop a greatly increased science and technology capability. A key element is the system of "individual responsibility for technical work" in the scientific research institutes and "the system of division of responsibilities among institute directors under the leadership of party committees". On judging the work of the party committees of the scientific research institutes Teng Hsiao-ping stressed that "the main criterion for judging the work . . . should be the successful fulfillment of the task of producing as many scientific results and training as many highly competent scientific and technical personnel as possible".[9] It is interesting to note that personnel is to be trained for management of scientific research, apparently at the Chinese University of Science and Technology which is under the leadership of the Academy of Sciences.[10]

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[3] Fang Yi's report at the National Science Conference, Hsinhua News Agency (Peking, Mar. 28, 1978), No. 10666.

[4] *ibid.*

[5] Vice Chairman Teng Hsiao-ping on self-reliance and learning from others, Hsinhua News Agency (Stockholm), 1978, No. 71.

[6] Vice president of Chinese Academy of Sciences on policies guiding work, Hsinhua News Agency (Peking, Mar. 30, 1978), No. 10668.

[7] Fang Yi's report at National Science Conference, Hsinhua News Agency (Peking, Mar. 28, 1978), No. 10666.

[8] President of Chinese Academy of Sciences Kuo Mo-jo calls for new vitality in philosophy and social sciences, Hsinhua News Agency (Stockholm), 1978, No. 63.

Finally, the publication of scientific and technical journals has apparently been fully resumed. The library at Tsinghua University in Peking for example stocks more than 1,000 current Chinese-language periodicals published in China and all related to science and technology.[11] Many of these are still for internal circulation only and may in cases only be available on exchange basis between research institutions, universities, colleges, et cetera. That only a limited number of copies are available is obviously the case, as those use pasted photographs for illustrations. The periodicals cover a large number of technical fields with prominence to electronics and metallurgy. A large number of them are abstract journals on foreign literature while others contain full translations of foreign articles—all of which closely reflects the situation in periodicals publication prior to the cultural revolution.

Policy Issues

We will discuss China's technology policy in terms of policy objectives, and strategies with their instruments and various conditioning factors, with an emphasis on the post-cultural revolution period. We will then move on to a presentation of China's two-leg strategy for development, self-reliance, and open-door scientific research after which we will also briefly discuss the role of the intellectuals.

The development of science and technology in China must be seen against the characteristics of the country. First, China is a developing country with a rural population majority, most of which are still engaged in agriculture. Second, China is a very large country with great regional variations and a diverse economy. Third, and not of least important, the People's Republic of China is committed to socialist planning with the ultimate aim of developing a Communist society.

The concern for industrial modernization and technological development both in the civilian and military sectors should not be evaluated only in our frame of reference but also with the historical experience of China in mind. This viewpoint was underlined in a joint editorial by the People's Daily, Red Flag and Liberation Army Daily at the end of the Fifth National People's Congress.[12] With a quotation from Mao Tse-tung we are reminded that from 1840 to 1945, China suffered great humilitations at the hands of imperialist countries. Almost all imperialist countries "whether large, medium, or small" committed aggression against China. The editorial states that this was due to two factors, the corrupt social system and secondly the backward economy and technology. As for the first factor China has already put her house in order even if it is admitted that "the solution is still incomplete, because class struggle still exists." But for the second factor China has only achieved some change and the country "will require several more decades to bring about a complete change." But if this is not done within the next few decades "it will be impossible for us to avoid being pushed around again."

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[9] Vice Chairman Teng Hisao-ping on party leadership over scientific and technological work, Hsinhua News Agency (Stockholm), 1978, No. 71.

[10] Vice president (Li Chang) of Chinese Academy of Sciences on policies guiding work, Hsinhua News Agency (Peking, Mar. 30, 1978), No. 10668.

[11] Information from the author's visit to China in late March and early April 1978.

China's policy for scientific research and technological development is influenced through political, ideological, and other societal values which should be termed long-range objectives. These are international as well as domestic in character. The long range objectives may be taken to be the attainment of a perfect communist society, organized in completely decentralized and self-sufficient units and on the principle of distribution according to needs. Internationally, the long range objectives are a full realization of China's ideal of justice and equality throughout the world. Such objectives would in the reality of international relations mean in part, an elevation of the Third World countries into a central position in the world.

The short term objectives are: internationally, to increase national independence to counter threats of the super powers, to prevent the Third World and particularly its natural resources from falling into the hands of the superpowers; primary international importance is likewise directed to finding workable arrangements which would ensure the national security of China and the continued progress towards the achievements of the long range foreign objectives; domestically, to rapidly develop Chinese industrial strength as an initial and necessary requirement to achieve her overall objectives.

In this, China's technology policy must fulfill three major objectives. First, to enable a better utilization of natural, capital and human resources. Second, to raise the country's overall level of technological sophistication. Third, to decrease production costs and improve product quality. Achieving these objectives would ensure a higher standard of living, a greater range of long term options, and more bargaining power in the world market.

China's technological policy is, in the modern sector of the economy, in general terms, still focused primarily on the problem of catching up—technologically, industrially, and economically—with the most advanced countries of the Western World, including Japan. This preoccupation should not be mistaken as a mere desire to imitate or emulate what industrialized countries have been doing. The objective of China's technology policy should be seen as a conscious attempt to obtain the technological and industrial means for achieving the political position to which it is entitled by virtue of its culture, history, and its social traditions. Furthermore, China's technology policy is also aiming at achieving social objectives in particular in the traditional sector of the economy as the Chinese leadership is committed to egalitarian goals and a high degree of participation.

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[12] Editorial by the People's Daily, *Red Flag* and Liberation Army Daily entitled "Transform China in the Spirit of the Foolish Old Man Who Removed the Mountains" [Mar. 6, 1978], BBC FE/5757/C/1.

Technology policy in China today cannot be fully understood without realizing the underlying dual economy development strategy. This gives rise to a variety of technology demands which have to be met with distinctly different technology policies. Consequently, there is increasing evidence to show that China is pursuing a "dual policy" in organizing research and the distribution and application of results.

In order to understand this, it is necessary to differentiate among the various sectors where R. & D. results are required. Long-term projects with great demands on resources generally require specialized research workers with long education. The control of such resources—financial and manpower—also requires substantial organizational resources. These projects are found particularly within the defense and the modern industrial sectors. The priorities here are set by national agencies, and popular participation in the decisionmaking process is almost nonexistent.

As various economic sectors in a society require different types and mixtures of R. & D. resources, the distribution of resources between basic research and grassroot applications must also vary in the different sectors. The level of development and the consequent need for and availability of new resources has implications for the distribution of resources along the various parts of the innovation chain. This in turn has consequences for the forms utilized to organize research and development.

This balance comes out very clearly in the following five principles which are now seen as guiding the development of technology and science in China:[13]

> (1) On the relationship between politics and technique, the report stressed that it is wrong not to criticize the tendency of ignoring politics; on the other hand, it is also wrong not to encourage scientific and technical personnel to study professional knowledge.
>
> (2) On the question of scientific and technical personnel integrating with the workers and peasants, it is wrong not to criticize the tendency of belittling the role of the masses in scientific research, and it is equally wrong not to give full play to the role of specialized research institutes and specialists.
>
> (3) On the relationship between scientific research and production, it is wrong not to call on scientific and technical personnel to do research and solve urgent problems in actual production; on the other hand, it is equally wrong to overlook or deny the importance of research in basic theory and the necessity of laboratory work.
>
> (4) On the question of remolding intellectuals and enlisting their service, it is wrong to assume that the remoulding of their world outlook has more or less been completed; on the other hand, it is equally wrong to maintain that they cannot be of any use until they have remolded themselves completely.
>
> (5) On the question of the relationship between Marxist philosophy and the natural sciences, it is wrong to deny the guiding role of philosophy in relation to the natural sciences; on the other hand, it is equally wrong to think that the former can substitute the latter and that concrete conclusions on specific scientific problems can be arrived at by relying on the general principles of philosophy.

Finally, we should remember that the professionals in advanced countries regard social change as a consequence of technological development. So the technological development is seen as a force that is changing the social organization. The view prevailing in China during the cultural revolution has been that social changes should occur simultaneously or should even precede technological changes. Consequently, the earlier "gang of four" attempted a full integration between production and research in order to reduce or even eliminate any barriers and distinctions between researchers and the people.

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[13] Chung Ko: "The Struggle Around the Outline Report on Science and Technology," Peking Review, 1977, No. 44, pp. 5-8.

This should be seen in the light of historical experience of the now advanced countries. Here, the scientific and technological progress achieved over the past 200 years followed rather than preceeded social transformation. This kind of development has its parallel—at least partially—in the rural areas of China. The agricultural sector has undergone a tremendous social transformation since 1949 exemplified by collectivization, the commune reform and large scale mobilization of people for development projects. It is also in this sector of the economy that the mass science approach appears to have been most successfully implemented. But the question if social change should precede or follow from research and technological development has been a very fundamental one in China.

The intense political debate raging in the scientific and technological circles in China over the past couple of years has finally been resolved. It has been clearly stated that scientific research must precede production and the outcome has been strongly influenced by an increasingly strong awareness that China's material base has to rapidly expand and that science and technology are important and efficient instruments in order to achieve this.

To understand better how technology is created and diffused within Chinese industry, we must look more closely at the structure of industrial production that has gradually evolved in China. It is helpful to distinguish among three different modes of production. These are differentiated quite sharply here for purposes of underlining the distinct character of each, although, in fact, categories often overlap. The three modes are ranked in descending order of technological sophistication:[14]

(1) Scientific laboratory industry,
(2) Urban industry,
  (*a*) Centrally controlled large-scale basic and military industry,
  (*b*) Province and municipality-controlled medium-scale industry, and
(3) Rural industry (at county, commune and brigade levels).

The workshops in the first category—including their scientists and institute sponsors—are predominantly oriented toward achieving self-reliance in high technology. Their interest in foreign technology, therefore, is limited to scientific information, technical literature, scientist exchange, specialized instrumentation, and so forth. Quantitatively, the sector stands for a limited claim on foreign technology.

Both the large-scale central plants and the smaller scale provincial and municipal plants are major users of foreign technology. The potential here for foreign technology extends across the entire technology spectrum from critical materials that lie beyond China's technical capability to produce, high performance end-products that are urgently needed for the priority tasks of the Chinese economy, sophisticated equipment obtained as single prototypes for copying, and most important imports of complete plants to boost output in key industrial sectors.

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[14] Heymann, Jr., Hans: "China Approach to Technology Acquisition, Part III—Summary Observations." 72 pages, Santa Monica, Calif., 1975 (R-1575-ARPA), (a report prepared for Defense Advanced Research Projects Agency), Rand Corp.

The significance of the rural industrial sector has until quite recently been overlooked by most foreign observers. This is no longer possible with 17 million people employed in collectively owned—that is, commune- and brigade-run enterprises—and at least another 6 million people in state-owned enterprises located in rural areas. Thus, a total of at least 23 million Chinese work in rural industries which amounts to about 40 percent of China's industrial labor force in 1977.

China's development is in the late 1970's still based on a two-leg strategy with a spectrum of enterprise sizes, technical sophistication and administrative control. Foreign technology can easily and without much modification be transferred to one end of the industrial spectrum. In other words, the foreign technology is on the whole consistent with the Chinese organization that exists in large centrally controlled high-technology industries.

Self-Reliance [15]

Self-reliance is conditioned by two major factors. First, self-reliance is primarily a function of the economic and political structure of the country. Second, it is also a function of the size of the country because only if manpower and natural resources are available on a sufficiently big scale can an independent technological and industrial base be established. Naturally, all countries cannot apply the Chinese concept of self-reliance. Most countries stress self-reliance to mean only the elimination of special forms of external assistance.

In China self-reliance is practiced at two distinct levels—local self-reliance and national self-reliance. In either case it would confuse the understanding of self-reliance if it were reduced to a formula for economic relations alone. Self-reliance practiced at these two levels is conditioned by external factors and contains in both cases a partial or full rejection of the outside goal structure. Thus, at the national level China rejects the goal structure of the industrialized countries including that of the Soviet Union. Similarly, the rural localities in practicing self-reliance reject the goal structure of the Chinese cities. Thus, China has much more control over external factors in the case of local self-reliance than is the case at the national level.

Self-reliance in rural modernization has come to mean that a locality—team-brigade, commune or even county—has basically to raise its level of development and standard of living through mobilizing locally available resources and investing the surplus in new projects. Machinery and technology from the outside will mainly be available as catalytic agents—similarly to the role played by imported technology in the modern sector. The consequence is that the level of investment and the allocation of manpower are policy issues which are basically left to the locality to decide upon. However, the local development is dependent on a number of critical inputs, and the political need today to speed up rural modernization clearly indicates that larger amounts of inputs might be available, a parallel to the presently increasing role of imported technology in the large-scale sector. This no doubt reduces the self-sufficiency of rural areas even if the concept of self-reliance is maintained. The same is of course true for China's self-reliance on the international scene.

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[15] This section is partly based on valuable insights gained from reading "Technological Dependence/Self-reliance: An Introductory Statement," by Onelia Cardettini, prepared for the Science and Technology Policy Instruments Project, April 1975.

In practicing self-reliance at the local level the Chinese leadership is facing a number of problems. First, it is not possible to reduce spatial inequalities which are due to different factor endowment, different ability to mobilize creativity in the masses, and different levels of mobilization of the population in general. This may then create a new vertical distinction between self-reliant and non-self-reliant units. Second, self-reliance at the local level may cause exploitation to solidify if the basis remains unchanged and this may be the case in places where genuine mass involvement is lacking.

Without making a deeper analysis here it appears obvious that China's self-reliance does not mean autarky. There is obviously scope for international transfer of technology, to facilitate the growth of the country's economy even if the thrust is an adaptation and the generation of domestic and local technology.

China has since the early 1960's been committed to a global, long-term policy of technological self-reliance. This has at times had very strong political overtones—strongly influenced through the split with the Soviet Union in 1960 which left China for a number of years without a major external supplier of advanced technology. However, China has implemented strict technological self-reliance only as a sectoral policy in industrial sectors, which from the defense point of view have been considered of extraordinary importance. It could be argued here that China would have found no willing supplier of defense technology after the Soviet Union withdrew its assistance and consequently, China had no other choice.

China's defense sector has reached a high level of sophistication in the production of a number of weapons; technology from the outside is not accessible unless China makes political concessions which are for the time being ruled out. So, the defense sector receives negligible amounts of imported technology and hardly any outside technical assistance—a situation which has existed since the Soviet Union withdrew her military technology assistance in the late 1950's. Defense technology can be imported only if it is unclassified—or obtained through undercover methods. Consequently, the defense sector must be seen as a separate entity as it is a sector which as far as technology policy is concerned operates very much in isolation even if there are close connections with various civilian industrial sectors. Her achievements in aeronautics and computers have been quite substantial. It has been shown that China has generally succeeded in reducing the time lapse between the various steps in comparison with the advanced industrial nations and the indicators examined by Macioti[16] have shown that China's scientific and technological progress has been truly noteworthy. See table 1. However, Chinese sources have in 1977 indicated that progress in recent years has been less remarkable.

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[16] Macioti, Manfredo: "Scientists Go Barefoot," Successo, January 1971.

TABLE 1.—CHINA CLOSING THE TECHNOLOGICAL GAP [1]

Program	Year					
	United States	U.S.S.R.	Britain	France	Japan	China
Nuclear:						
1st reactor	1942	1946	1947	1948	----------	1956
1st A bomb	1945	1949	1952	1960	----------	1964
1st H bomb	1952	1953	1957	1968	----------	1967
Space: 1st satellite	1958	1957	----------	1965	1970	1970
Aeronautics:						
1st jetplane	1942	1945	1941	1946	----------	1958
1st mach 2 jet	1957	1957	1958	1959	----------	1965
1st 8,000 kg engine	1958	1957	1957	1966	----------	1970
Computers:						
1st prototype computer	1946	1953	1949	----------	1957	1958
1st commercial use of computer	1951	1958	1952	----------	1959	1966
1st transistor	1952	1956	1953	----------	1954	1960
1st integrated circuits	1958	1968	1957	----------	1960	1969

[1] Macioti, Manfredo: "Scientists Go Barefoot," *Successo*, January 1971.

Very few data are available which show the gap in technological development between China and the major industrialized countries. Aside from the articles by Manfredo Macioti which clearly indicate a dynamic catching up in a few selected sectors, very little systematic comparison of technological levels are available to the author. However, in a recent book on China's energy, which will be briefly referred to here, Vaclav Smil has attempted to indicate the level of selected energy technologies.[17]

He says that the mechanization of coal extraction remains low in comparison to the major industrialized coal producers like United States, Great Britain and U.S.S.R. More than one-half of all coal is still extracted, loaded and conveyed mechanically while these operations are almost 100 percent mechanized in United States and the U.S.S.R. He also points out that oil exploration and production has distinct gaps.

None of the principal energy transportation technologies is well advanced in the PRC. For example, the largest oil tankers built in China are still very small compared with the average size of a European tanker currently in service. Extensive construction of pipelines has only started. Still more important, coal handling is not at a high level of development, although coal constitutes a large proportion of total transportation.

Smil also mentions that the development of high-voltage transmission lines has not been remarkable and indicates that the upgrading of maximum voltages is lagging even if the necessity of high-voltage direct-current links already has been stressed. Similarly, gas-turbine technology in China is only in its initial stages of development.

Smil considers that power generation is an area where China has been most successful in narrowing the technology gap. This is partly a reflection of the transfer of power technology from the U.S.S.R. and Czechoslovakia in the 1950's. The Chinese engineers are today able to design and manufacture thermal and hydrogenerators up to 300 megawatts. Smil points out that this achievement is quite respectable but China is "still far behind the current and impending Western and Soviet levels, especially in thermal generator capacities." However, China has been a pioneer in development of direct cooling for hydraulic and thermal units. Smil mentions that "(T)hey constructed the world's first 12-megawatt steam turbogenerator with inner rotor and stator water cooling in 1958 and introduced 300-megawatt water-cooled sets, both hydro and fossil fueled, in 1971–74."

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[17] **Smil, Vaclav,** "China's Energy" [Praeger Publishers], New York, 1977.

Restrictions imposed upon China from the outside, however, have meant that China has accepted or almost completely attempted to follow the principle of self-sufficiency in certain sectors. This applies to defense production. It has also been true for those civilian sectors where the industrialized countries have maintained an embargo on what is termed "strategic goods." Occassionally, China's politicians and planners have attempted to interpret self-reliance to mean self-sufficiency which happened during the Cultural Revolution. However, even under such circumstances it has been realized that self-sufficiency cannot be achieved in all production sectors unless China is willing to pay a very high price in developing domestic resources and delaying the modernization. This dilemma will be illustrated by referring to the Chinese debate.

China began in 1972 to import complete sets of equipment used in producing chemical fibers and fertilizer and began in the following year to export crude oil to a number of capitalist countries. Teng Hsiao-ping was apparently one of the advocates of this policy. He was said to have advocated the importation of foreign techniques and equipment in order to speed up the technical transformation of industry and raise labor productivity. He is also said to have proposed that this should be done as a major policy under which China would sign long-term contracts with foreign countries. China would then get access to the latest and best equipment which would be paid for by mineral exports. The opponents saw this as "national betrayal" and claimed that: [18]

> * * * guided by the principle of independence and self-reliance, it is necessary to import some foreign techniques and equipment on the basis of equality and mutual benefit and in accordance with the needs of China's socialist revolution and construction. But the Chinese people absolutely cannot rest their hopes of realizing the modernization of our national economy on imports. If we do not rely mainly on our own efforts, but, as Teng Hsiao-ping advocated, rely solely on imports of foreign techniques, foreign designs and technological processes and imitate foreign equipment, we will trail behind foreigners and the country's technical development of the whole national economy will gradually fall under the control of foreign monopoly capital.

In the article we learn that Teng Hsiao-ping considered that the policy had three important advantages as it would enable China to export, to promote technical transformation, and to absorb labor power. On this the opponents had the following to say: [19]

> This means nothing less than opening the gates wide to foreign monopoly capitalists, who would use money and equipment to plunder China's natural resources and suck the blood of the Chinese people whom they regard as low cost manpower. The Chinese people have had more than enough of such advantages before liberation. If this capitulationist major policy of Teng Hsiao-ping's is followed, China will be reduced step by step to the level of a raw material supplier for imperialism and social imperialism and an outlet for their commodities and investment. This fully reveals the reactionary features of Teng Hsiao-ping, who works as a comprador of imperialism, representing the interests of foreign big bourgeoisie.

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[18] *Red Flag* article on Teng Hsiao-ping's comprador bourgeois economic ideas, Hsinhua (Stockholm); 1976, No. 182 (Hsinhua, Peking, July 30, 1976).

[19] *Ibid.*

There can be no doubt that an important factor by which an industrially backward country can overtake an industrially advanced country is the adoption of advanced technology. The high technology base in China is still quite narrow, a fact which has been pointed out by foreign observers and admitted by the Chinese. In order to speed up the development of the petrochemical fiber industry and thereby contribute to solving the clothing problem of the people, several complete sets of equipment for the production of chemical fiber to be based on petroleum products were imported.[20] In this way China could within a relatively short time transform the petrochemical fiber industry. The importance of using foreign technology lies in its ability to achieve operational efficiency in a short time. However, this usually requires the simultaneous development of infrastructure like transportation, training and maintenance facilities, among other things.

When developing technology and choosing between different alternatives a developing country has to give special consideration to the following three aspects. First, technology has become increasingly complex—a complexity which is usually found not only in the production process but also in the product itself and in the distribution system. Second, technology is constantly changing in all three dimensions mentioned. A major reason for this is that most technology originates in industrialized countries where a demand for continued growth and higher real wages leads to a 5- to 6-percent increase in efficiency/productivity annually. Over a period of 5 years this amounts to 30- to 35-percent increase in productivity/efficiency. Third, the educational needs are very considerable which are to a large extent a consequence of the first two considerations.

From such facts we can see that China experienced a very acute struggle over the question on how and to what extent China should make use of foreign technology. The issue has been more or less resolved which can be seen from the following statement when the substance of self-reliance is discussed by a leading member of China's planning commission.[21]

> We don't practice autarky by locking our doors against the world. We will make positive efforts to have economic and technical exchanges with foreign countries and expand our foreign trade. Following development in industrial and agricultural production, we will sell more and more petroleum, coal, and other products in order to buy advanced foreign equipment. China does not accept loans from foreign governments, nor do we collaborate with foreign countries in the exploitation of our resources. In some areas of economic exchange, China will continue to adopt the usual international practice of deferred payments. Advanced techniques and experience are the common wealth of the working people throughout the world and China will make efforts to learn and master them.

The usefulness of importing plant and machinery becomes obvious when related to the ambitious modernization plans which were spelled out in some detail at the fifth National People's Congress held in February 1978.

At the time Premier Hua Kuo-feng mentioned that China in the next 8 years plans to build 120 large-scale projects which would include among other things 10 iron and steel complexes, 10 oil and gas fields and 6 new trunk railways.[22] While the emphasis is on large-scale projects the Premier iterated that "* * * every attention must also be given to the development of medium-scale and small enterprises."

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[20] Denouncing the absurd theory of the "gang of four" on the question of introduction, by the criticism group of the Second Designing Institute under the Ministry of Light Industry, *People's Daily*, July 3, 1977, CMP-SPRCP-77-28.

[21] Leading member of Planning Commission on China's Modernization, Hsinhua, Dec. 31, 1977, Hsinhua News (Stockholm), Jan. 3, 1978.

The Premier also said that China would by the year 1985 produce 60 million tons of steel—against approximately 25-30 million in 1978—and that the annual increase in industrial output value would exceed 10 percent in the coming 8 years. In describing the industrialization policy he also pointed out that China will develop a regional economic system with six major regions, and that the modernization drive will provide China with "14 fairly strong and fairly rationally located industrial bases." [23]

In addition to the development of the basic industries the Premier also stressed that China would have "much more developed petrochemical, electronics and other new industries" and that the country "would build transport and communications and postal and telecommunications networks big enough to meet growing industrial and agricultural needs." [24]

The close link between importation of technology and Chinese exports can be seen in the 8-year "private" trade agreement that China signed with Japan.[25] Under this China will import US$10 billion of plant and machinery during a 3-year period beginning April 1, 1978. Included in this agreement may be an integrated coastal steelworks with an annual capacity of 6 million tons to be delivered by Nippon Steel and constructed in Shanghai. China is to pay for her imports from Japan by mainly exporting crude oil and coal. Apparently there is a strong mutual interest in promoting a trade whereby technology will flow from Japan in exchange for raw materials, in particular minerals. This is obvious in the Jetro newsletter from early 1978, which says that:

> . . .because the important items which China wants were listed in definite terms in the contents of the agreement, e.g., plant related items like coal mining and coal dressing equipment, transport equipment, port and harbor equipment, petroleum mining equipment, metallurgical equipment, equipment for the petrochemical industry, equipment for electricity generation, et cetera, technological materials such as patents and know-how; and building materials with the emphasis on iron and steel. Naturally, these items were very attractive to Japanese industry, currently distressed over the stagnation of business. Moreover, the hope was probably that in the long term this agreement may lead to the construction of a progressive framework for strengthened economic ties between Japan and China. On the other hand, there were also strong requirements on the Chinese side to rehabilitate the economy and pull it out of the chaos and the destruction caused by the Gang of Four and to achieve as quickly as possible its "four modernization." [26]

The trade agreement indicates that Japan will remain China's biggest supplier but China will also sign big contracts elsewhere—possibly under the umbrella provided by the 5-year trade agreement with the European Economic Community signed in early 1978.[27]

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[22] Chinese Premier announces building of 120 large-scale industrial projects [Peking, Mar. 6, 1976], Hsinhua [Stockholm], 1978, No. 58.

[23] BBC FE/5757/i.

[24] Premier Hua Kuo-feng puts forth 1985 economic norms [Peking, Mar. 6, 1978], Hsinhua News [Stockholm], 1978, No. 58.

[25] "Machines for Oil," the Economist, Feb. 18, 1978.

[26] "The Japan-China Long Term Agreement," Jetro China Newsletter, No. 16 (January 1978).

[27] "Recommendation for a Council Regulation—Concluding the Trade Agreement Between the European Economic Community and the People's Republic of China", Commission of the European Communities, COM(78), 68 final, Brussels, Feb. 22, 1978.

Open-Door Scientific Research

One of the major subjects in the intense debate on science and technology policy in China has centered on the role of open door scientific research. Another vital issue, of a related nature, has been the relative importance of experts.

Open door scientific research was introduced during the cultural revolution and had the following two main features: First, it was based on a three-in-one combination of workers or peasants, cadres, and researchers. Second, it was also based on a three-in-one combination of research, production and application. The aim was to integrate laboratory work with the extensive practical experience of workers and peasants which would then help "the ideological remolding" of the intellectuals through working and living together. At the same time it should promote the development of scientific research.

There were several ways of conducting open door scientific research.[28] The Chinese Academy of Sciences, for example, practiced the following three forms: First, it encouraged the researchers to leave the laboratories and involve the people in factories and communes concerned with research problems within the units. Second, it opened up the research institutes and invited people to come there to do scientific research. This also included the encouragement of institute workers to participate in research and management. Third, it also provided open door service by accepting visitors asking for assistance on research matters, a form which often involved the training of technicians. At its peak the open door scientific research programs of the Academy involved several thousand researchers who regularly went to the factories and to the countryside.

The number of people participating in the China "research system" through attempts to carry out research and make innovations, as well as in technical education and the popularization of technical and scientific knowledge is most likely much greater in relative terms than in any already industrialized country. This contrasts greatly with the situation in the countryside in most developing countries. Particularly, the scientific invasion of the countryside is bound to stimulate the minds of rural people in new directions, undermine their superstitions, and open up the path for their intellectual emancipation and full participation in the modernization of China.

However, the program tended to drain so much resources from the research institutes that many places had little time and opportunity to do research in other equally important areas. Occasionally, open-door research also meant the transfer of equipment. As some of the shortcomings became evident and changes were suggested to remedy the situation the "radicals" apparently counteracted in stressing the political unrealiability of intellectuals in general, and scientific researchers in particular. Consequently, they should be controlled and remolded and open-door research was one of the instruments for this. Simultaneously reports were published which indicated that the method had no disadvantage on the use of resources or for reaching scientific goals.

The criticism against the open-door research with its emphasis on "the three-in-one combination of leading cadres, experts, and masses" does not mean that the program should be scrapped. However, it is now being stressed that an important condition for doing a good job in this area is that the professional contingent should be the backbone. And a further measure should be "to train more working class technicians, engineers, and scientists, constantly expand and improve this contingent and make them the backbone of China's scientific endeavours".[29] This ,of course, indicates a reduced role for mass-based science when China at some time in the future has considerably increased the professionals with training from colleges and universities.

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[28] "Open Door Practice—Correct Way for China To Develop Scientific Research", NCNA, Apr. 4, 1976. Survey of People's Republic of China Press, CMP-SPRCP-76-15.

It may be questioned if the open-door research and the integration of researchers with workers and peasants really had the impact on the scientific research establishments now implied in the criticism against the gang of four. In a study of the journal Scientific Experiments, the publication of which was announced in April 1971, Rawal says that the picture that emerges for 1974 is that the coverage to articles written by workers-peasants-soldiers or to innovations made by such groups is limited.[30] This is still more true for Scientia Sinica—the journal of the Chinese Academy of Sciences—where many articles during 1974 carried a plea for a renewed interest in research in the basic sciences.

There are two main interpretations of what Rawal and others have observed on the discrepance between policy and implication in science and technology. One possibility is that the "radicals" were right in stating that the policies—advocated by Mao Tse-tung—failed because they were thwarted by the intellectuals and other power holders who wanted to reinstitute the system that had existed before. Another possibility and the one underlined by the present leadership is that the new ideas and policies could not be implemented—at least at the present stage of economic development—and consequently the gang of four advocating such mistaken beliefs had to be removed.

The Intellectuals

"Industry and agriculture are progressing. What should we do with culture and education? What should we do with the scientific research? What should we do with the intellectuals in this mass movement?" [31]

These questions were asked at the end of a long article which was published in summer 1977. Here the Red Flag, the theoretical journal of the party, discussed the earlier policy towards the intellectuals. In this context, as in many others, the gang of four was accused for having carried out wrong policies with the consequence that the intellectuals were pushed aside, and important assets for China's modernization wasted.

Technicians, engineers, and researchers is a comparatively small group—at most a couple of million. However, there can be no doubt that this group is now being treated differently although mass science and the significance of the nonexpert is still being stressed. But, technical and scientific personnel will again be given titles and transferred to places where they can use their competence, as well as having more time for their work.

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[29] *Red Flag* article discusses modernization of science and technology in China, *Hsinhua* (Stockholm), 070505, Peking, July 5, 1977.

[30] Rawal, S.P.: "Reflection of the General Line in Science and Technology:" A study of Scientia Sinica (1974) and Scientific Experiments (1974), *China Report*, vol. 12, No. 5 (September-October), 1977, pp. 3-15.

[31] *Red Flag*, July 1977;

The alternative views—represented by the gang of four—criticized the intellectuals because they were likely to consider knowledge as private property. This is now being said to have meant a criticism of knowledge as well as the carriers of the knowledge. This in turn might have created a situation where the Chinese people would not have been willing to learn new knowledge—with disastrous consequences for China's future development. Here is a central issue. The gang of four maintained, according to the reports reaching us, that the individuals who acquired new knowledge might become enemies of socialism and, consequently, had to be treated accordingly.

A number of policies and measures are now being implemented which can be summarized in the following six points: First, the intellectuals are accepted as an important asset and force in the modernization of the country. Second, the principle of letting a hundred schools of thought contend is an fundamental approach in the development of science and technology. Third, technical posts entail specific responsibilities. Fourth, all research institutes practice the system of directors undertaking responsibility under the leadership of party committees. Fifth, an adequate number of work hours for professional work are insured. Sixth, titles for technical personnel are restored, being part of the inventive system.

On the question of incentives and evaluation of research workers Kang Pai, head of the leading group of the Institute of Physics, had the following to say:[32]

> We are establishing a system for the evaluation of scientific and technical workers, restoring titles for technical personnel, enforcing the system of keeping evaluation scores, and using various other systems including that of personal responsibility and participation by the masses in managerial work.

As an element of the preparations for the coming national science conference we learn from Hsinhua News Agency that workers are busy making medals and certificates of citations to be awarded to outstanding groups and individuals at the conference. The office, set up to prepare the conference, disclosed that several thousand scientists, technicians and other people have been recommended for that honour.[33]

The recent debate in education and on the role of the intellectuals including those working in the technical and scientific fields have centered on two issues. One is the question if the bourgeois or the proletariat exercised the control over education in the years preceding the cultural revolution. The other question is whether or not the great majority of the teachers and students graduated in those years were bourgeois in world outlook.

The gang of four also appeared to have claimed that those who received education were likely to turn into intellectual aristocrats and consequently saw mass science as a countervailing force which should be supported by all means. Their views on this matter of course had an immediate bearing on the treatment of people of particular talent. Yang Cheng-chung, a research worker at the Academy of Sciences, writes that "as a result, young scientific workers could not receive excellent training, and the average age of the contingent was higher than normal." He also says that "the gang of four tried in every way to attack the young scientific and technical personnel who were aces in their vocational work."[34]

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[32] Peking Home Service, Sept. 29, 1977, BBC FE/5634/B11/6.

[33] "Peking Scientists and Artist Look to 1978 With Confidence," Hsinhua (Peking), Jan. 2, 1978, Hsinhua News, Stockholm, Jan. 3, 1978.

The intellectuals in China are now given an opportunity to make their full contribution to China's modernization. From available evidence, this does not indicate that the role of masses in scientific research will be belittled, nor will it mean that scientific and technical personnel will refuse to solve urgent problems in production. But the confusion over organization and policy over resources in science and technology has disapperared.

In their positive evaluation of the intellectuals, the new leadership refers to comments that Mao Tse-tung made back in 1957. Mao then indicated that 3 percent of the intellectuals were hostile—that is toward the Party. There were also hesitant groups but more than 90 percent of the intellectuals supported the socialist system—but in varying degrees, Mao said.

At the same time Mao also discussed the dictatorship of the proletariat. He mentioned that in China, at the time, the proletariat consisted of 10 million while the intellectuals at the same time numbered 5 million. We now learn that China had 20 million intellectuals in 1971 and that this number is too small considering the modernization programs of the country. Expansion of education in universities and colleges is required in order to support the industrial and technological development—particularly when China starts to rapidly expand new industrial sectors.

In addition there is reason to assume that China will experience a considerable expansion in employment in the administrative units of organizations as she proceeds on the modernization path. In particular we can expect an increase in the number of people responsible for the exchange and processing of information. The neglect of this quarternary sector is likely to have become more and more serious in recent years and may be one of the major reasons for revising the national policy toward education and the intellectuals.

RESEARCH AND DEVELOPMENT

Sciences and technology in China covers a broad spectrum of activities. It includes large scale scientific projects in satellites, nuclear weapons and advanced electronics as well as the diffusion of industrial innovations. It also includes the technology needed in large and small scale enterprises as well as the popularization of all scientific and technical knowledge required in agriculture or public health. Consequently, China has to find compromises under which resources can be allocated among the competing interests. No doubt regions, economic sectors and the various levels of the administration are likely to have different priorities.

The Chinese Academy of Sciences is the most important center for scientific research and has at times had a semiautonomous position under the government. Other research institutes are found within central and provincial government ministries and departments, within industrial enterprises and companies and at the universities. Following the development of regional science and the mass-based agricultural scientific network research units, although of a less sophisticated nature, can also be found within the relevant units of the lower administrative levels; that is, prefectures and counties.

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[34] Yang Cheng-chung, "Our Cause Requires the Aces." *People's Daily*, Aug. 11, 1977, BBC FE/5592/B11/3.

The total number of research institutes is not known. A recent tabulation made by Susan Swannack Nunn indicates that China has approximately 1,000 research institutes with 43 percent in life sciences, 34 percent in engineering and technical sciences, and 22 percent in physical sciences. The author points out that this includes only identified research institutes, excluding laboratories, universities, departments or scientific societies.[35]

We have attempted to provide a breakdown of the R. & D. budget by major categories in table 2. This shows that basic research receives 2.4 percent of the total R. & D. budget. The figure is possibly on the high side because it includes all R. & D. activities carried out within the institutes either under the direct control of the Academy of Sciences or under dual jurisdiction of the Academy and another agency. On the other hand, basic research may also be carried out in other sectors.

TABLE 2.—BREAKDOWN OF R. & D. EXPENDITURES IN PRC BY MAJOR CATEGORIES,[1] 1973

	Manpower		Expenditure	
	Thousands	Percentage	Billion yuan	Percentage
Basic research	21.3	1.8	0.11	2.4
Agriculture and natural resources excluding energy	418.1	35.1	.81	18.0
Medicine and public health	128.1	10.8	.52	11.0
Defense	193.6	16.2	1.00	22.0
Manufacturing, energy and transportation	429.6	36.1	2.15	47.0
Total	1,190.7	100	4.59	100.0

[1] Billgren, Boel and Sigurdson, Jon: "An Estimate of Research and Development Expenditures in the People's Republic of China in 1973." OECD Development Centre, Paris, July 1977.

Research and development in agriculture and natural resources receives 18 percent of the total R. & D. resources. The figure does not quite indicate the important role given to agricultural research since the sector is expanding and accounts for a larger share of manpower than the figure indicates. Medicine and public health receives 11 percent of R. & D. resources.

The 22-percent figure for defense, which may be much too low or much too high, should still be seen as an indication of the importance of military R. & D. in China. It is natural to find that manufacturing, energy and transportation receive a very considerable part of the total resources, a reflection of their importance alongside with agriculture.

These sectors add up to a total R. & D. budget of 4.60 billion yuan, in 1973, which approximately equals 2.27 billion U.S. dollars. This is roughly 1 percent of the gross national product of the PRC in 1973 (in 1973 U.S. dollars). This would indicate, if the estimated budget is a close approximation, that the general assumptions about the relative level of R. & D. expenditure in the PRC have generally been on the high side.[36]

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[35] Nunn, Susan Swannack, "Research Institutes in the People's Republic of China," United States-China Business Review, March-April 1976.

[36] Against the repeated emphasis on the gaps in science and technology between China and advanced countries and with the evidence indicating that this sector of the society was badly neglected or interfered with for a number of years it appears that estimated R. & D. figures are higher than what they actually were. This has been pointed out by Leo Orlans and is also supported by information and impressions gained during a recent visit to China by the author.

The estimates made here do not include the humanities and social sciences. The reason is twofold. The humanities receive very limited funds compared with the other major categories which are dealt with here. Second, most social sciences are carried out as investigations under the direct control of party organs which sets social sciences aside from all other R. & D. activities discussed in this paper.

However, it should be noted that in 1977, Peking established a Chinese Academy of Social Sciences and as an indication of its activities a number of social science journals are again being published after having being compelled to stop during the cultural revolution.

The structure of R. & D. and extension work in China consists, as pointed out by Lloyd E. Eastman, of seven levels.[37] Organizations at four of these levels are operated by the state—central government, provinces, prefectures and hsien (county), the lower three levels are collectively operated—in the commune, the production brigade and the production team. The lower three levels include much if not most of the mass science and a considerable part of the regionalized R. & D. Furthermore, the basic thrust of R. & D. in China after the beginning of the cultural revolution has been the expansion of the lower five of the seven levels mentioned.

China has made strong and consistent efforts to redistribute opportunities of generating technological and cultural change. This redistribution leads to a downplaying of the role of professional elites and foreign technology, and may be particularly relevant within the traditional and rural sectors.

The integration of innovation and production on one hand, and of technology and labor on the other, presents an obvious contrast to the development process in modern industrial societies. Modern technological activity outside China is based upon formal scientific training, highly specialized, and carried out in specific institutions which are almost exclusively geared to technological innovation. The Chinese approach may be highly successful as sectorial local-level technological policy—particularly in sectors where development is relatively less science-based.

It will be useful, in briefly discussing these institutions, to see them in relation to the administrative structures of a province. The levels of administration and the types of scientific and technological institutions paralleling these levels, include the following.[38] The relations of the various units and their interaction are also presented in figure 1.

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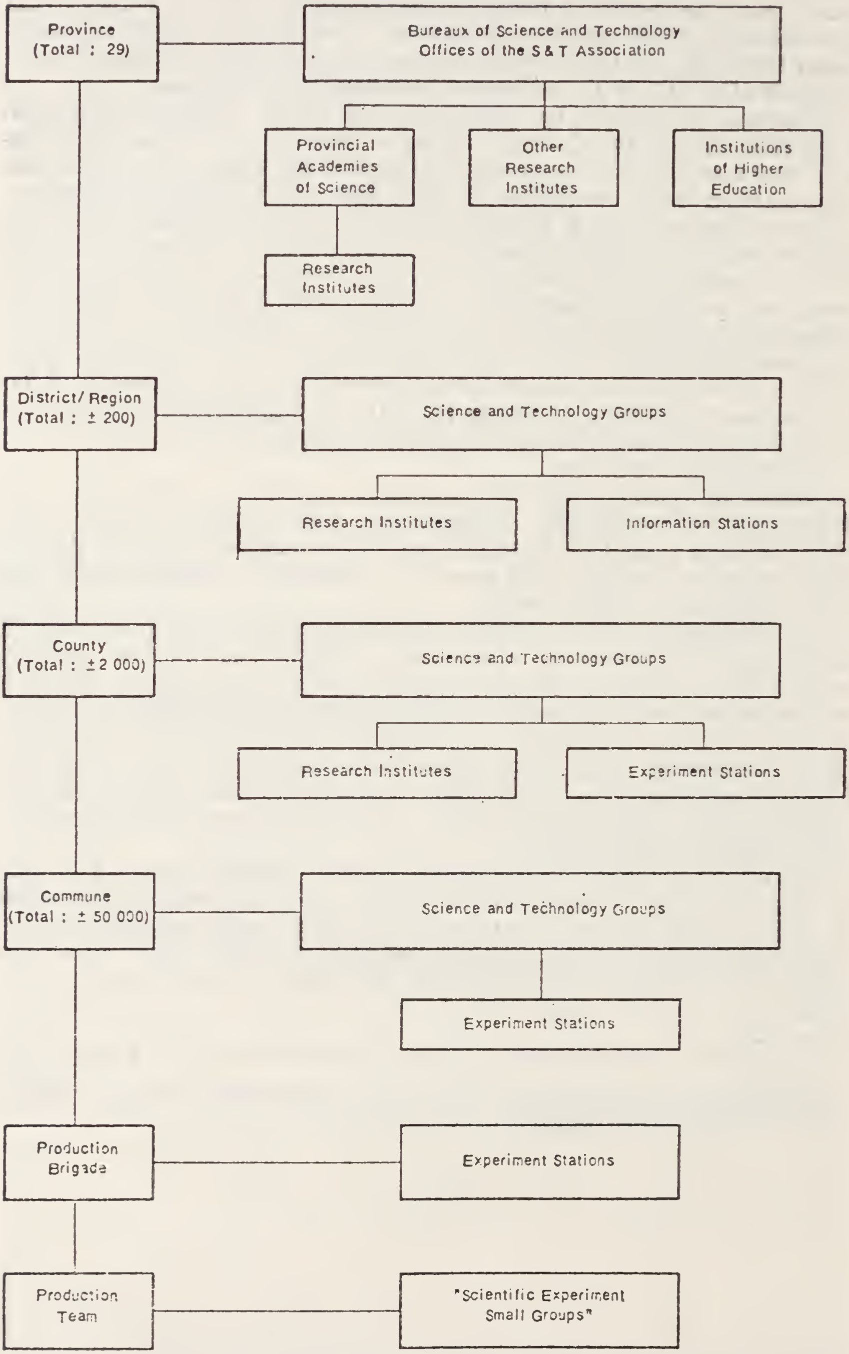
[37] Lloyd E. Eastman: "Politics and Populism: Implications for Wheat Production and Research" (Travel Report 1976).

[38] This presentation appears in Scientific Institutions in the People's Republic of China by Richard P. Suttmeier, Seminar Paper DSTI/SPR/76.4, OECD Seminar on Science and Technology in the People's Republic of China (Paris, Jan. 20–23, 1976).

FIGURE 1.—Science and technology institutions at various administration levels


Province
(Total : 29)
Bureaux of Science and Technology
Offices of the S & T Association
Provincial
Academies
of Science
Other
Research
Institutes
Institutions
of Higher
Education
Research
Institutes
District/ Region
(Total : ± 200)
Science and Technology Groups
Research Institutes
Information Stations
County
(Total : ± 2 000)
Science and Technology Groups
Research Institutes
Experiment Stations
Commune
(Total : ± 50 000)
Science and Technology Groups
Experiment Stations
Production
Brigade
Experiment Stations
Production
Team
"Scientific Experiment
Small Groups"

Source: Science and Technology in the People's Republic of China OECD, Paris 1977 (p. 60, ch. 3 on Scientific Institutions, by Richard P. Suttmeier).

In light of this it may be appropriate to view China's global science policy in terms of a hierarchy of science policies each with its own emphasis.

(1) Nation—military R. & D. energy, large modern industry.

(2) Province—agricultural R. & D., industrial development, medical R. & D.

(3)(*a*) Region—agricultural R. & D., industrial adaptation.

(*b*) Cities and large towns—industrial adaptations and transfers.

(4) County—agricultural adaptations, industrial transfer.

(5) Commune—agricultural transfer, industrial transfer.

We have finally made an attempt to use our estimate of the R. & D. budget to indicate the amounts that go to the science and technology units at the lower levels. Here we have included all units at provincial and lower levels which are specially geared to local and rural needs. The amounts received may be approaching 20 percent of the total national budget for science and technology and is still higher in manpower terms. See table 3.

TABLE 3.—ESTIMATED R. & D. EXPENDITURE AND MANPOWER IN 1973[1]

	Manpower		Expenditure	
	Thousands	Percentage	Billion yuan	Percentage
A. Total R. & D. costs in the Academy of Sciences, institutions of higher learning, and industrial research	611	51.3	3.16	68.7
B. R. & D. in life sciences, agriculture and medicine	122	10.2	.63	13.7
C. Mass scientific network (7,000,000 people, 2 hrs per week, each man-year valued at 1,000 yuan	290	24.3	.29	6.3
D. Regional science	168	14.1	.52	11.3
Total	1,191	100.0	4.60	100.0

[1] Billgren, Boel and Sigurdson, Jon: "An Estimate of Research and Development Expenditures in the People's Republic of China in 1973." OECD Development Centre, Paris, July 1977.

Basically, the task in provinces and at the still lower administrative levels is not so much of undertaking new research projects as that of extension. The research carried out at these levels should be of immediate relevance. So, the role of the lower levels is more to complement than substitute the research and development which is under the responsibility of the higher levels.

Basic and/or Mass Science

At a conference, in October 1977, for formulating a national plan for developing basic sciences some of the shortcomings of the past were indicated.[39] It was reported that, with the exception of some individual aspects of a few disciplines which rank among the world's best, most branches do not have enough research personnel and the level is not so high. Furthermore, experimental means are backward and there are blanks and weak links.

The new outline program for developing the basic sciences cover mathematics, physics, chemistry, astronomy, Earth science, and biology. In order to implement the program the Chinese Academy of Sciences should set up a rudimentary research network for the basic sciences within 3 to 5 years. This is expected to develop into a complete network covering a whole range of disciplines with modern laboratories in about eight years—according to a national plan. It is envisaged that before the year 2000 a big proportion or the overwhelming proportion of the various branches of the basic sciences will approach the advanced world levels of that period, while a considerable portion will catch up with these levels and some disciplines will surpass the world's advanced. So far we have no indication which disciplines will receive priority of personnel and financial resources in order to become the most advanced in the world at that time. No doubt, the forthcoming national science conference will devote some attention to this question.

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[39] See *Peking Review*, 1977, No. 46, p. 3, "National Plan for Developing Basic Sciences."

In 1971 it was stressed that the three-in-one scientific experiment groups and a scientific and technological network should be consolidated.[40] Throughout the reports it was stressed that in scientific experiments it was necessary to persist in the mass line and organize mass movements in a big way. The distinction between carrying out essential laboratory work in accordance with the needs of scientific research and carrying out laboratory research which is divorced from these things is accepted. But scientific research, production, and use should be combined and only those revolutionary intellectuals who have integrated well with the workers, peasants and soldiers and made inventions and created something should be praised and encouraged.

In a more recent article there is a reference to a Chinese-American physicist—presumably the Nobel Prize winner Yang Chen-ning—who in 1972 volunteered the suggestion: "Do not neglect the study of basic theory. The low level of natural science theory in China has to be raised." Chairman Mao, is said, to have praised this opinion and Premier Chou En-lai instructed Peking University to run its department of natural sciences well and actively to carry out theoretical research. He also instructed the science department to grasp theoretical research.[41]

We know relatively little about the intervening period but there can be no doubt that many important research projects were dropped and that many theoretical study organizations continued to exist only in name or even disappeared altogether. During the period of confusion efforts were made to discredit laboratories, set laboratory research against practice of production in society.

The new emphasis on scientific research is now evident in a number of ways including a Red Flag article discussing agricultural research. Here it is pointed out that it is wrong to overlook the role of special agricultural research institutes and scientists. Scientific experiments on a mass basis should be conducted. But it is also necessary to pay attention to the consolidation and building special institutes. There is also a need to adopt proper measures to increase manpower and equipment in these institutes.

All the attacks against the support given to basic theoretical research in natural sciences centered on the argument that "marxist philosophy is the basic theory for all sciences" and consequently also the basic theory of natural science. The discussion at the time reached a high degree of sophistry which is likely to be boring to most readers. The view that Marxism is basic also in natural sciences has been refuted and the counterargument can be most easily understood in the following way.[42] There are two relationships: One is the relationship between natural science and philosophy. The achievements of modern natural science, exemplified by the theory of biological evolution, provide a scientific basis for the philosophy of dialectical materialism, while the dialectical materialism becomes the philosophical basis of modern natural science.

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[40] Hunan Conference on Science and Technology (Hunan Provincial Service, Feb. 9, 1972), BBC FE/3913/B11/1. Hunan Daily editorial: "Unfold Scientific and Technological Research in a Big Way," Feb. 18, 1972, BBC FE/3924/B11/5.

[41] Ko Chi. The gang of four should not be permitted to strangle theoretical study of natural science, Wen Hui Pao (Shanghai), July 12, 1977 (broadcast by Shanghai city service, same day), BBC FE/5569/B11/16.

The other is the relationship between the applied sciences of various technologies in industry, agriculture, and medicine on the other hand and basic sciences like mathematics, physics, chemistry, biology, and geography on the other in natural science. Applied sciences provide a definite technical and practical basis for basic sciences, and basic sciences in turn become the basic theories of applied science. Consequently, the basic theories of technical sciences cannot be replaced by Marxist philosophy, which was implied by the gang of four.

When we today read the criticism and shortcomings we have to remind ourselves that the People's Republic made great achievements in a number of areas in the period after the cultural revolution.[43] On April 24, 1970, China successfully launched her first Earth satellite and on March 3 the following year launched a scientific satellite. And progress has no doubt been made in such areas as electronics, lasers, semiconductors and computing technology to mention only some of the areas. Even if most of work was geared to the demands arising directly out of production this did not mean that basic theoretical research was completely neglected. Chinese scientists successfully used the method of X-ray diffraction, at very high resolution, to determine the spatial structure of a molecule of crystalline pig insulin.

There are a number of indications that the intense debate over the integration of the professionals with the masses did not result in substantial changes of policy with regard to the high level professionals. However, there can no doubt that advanced science received little resources and that much work was seriously disrupted as a consequence of the political struggle.

Here, I would like to refer to an inquiry [44] which tried to find out whether and to what extent Scientia Sinica—the major organ of the Academy of Sciences—had been influenced by the Cultural Revolution. The questions were:

(1) To what extent have the goals of the cultural revolution, for example, mass participation—had consequences for the form and contents of the Scientia Sinica.

(2) Are there any indications that the Chinese have given up scientific tradition in the Western sense of the word.

It must be pointed out here that this inquiry is only concerned with one single scientific journal—even if this one may be the most prestigious in China. The results based on available issues from 1973 and 1974 compared with 1965–66 clearly indicate that there is a considerable gap between mass science and advanced science. And there is little indication that the elite scientists really have gone to the masses to get inspiration and ideas for solving problems. Anyway, this is not revealed in the published articles. Only a couple of articles have been written by peasants and workers. And there is no indication that the decentralization of the academies have resulted in advanced science being carried out at lower levels and in outlying areas of the country.

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[42] A political struggle around the question of the basic theories of natural science by the mass criticism group of the Ministry of Education. Kuang-ming Jih-pao, Jan. 16, 1977. Survey of the People's Republic of China Press, No. 6268 (CMP-SPRCP-77-4). The article also discussed another but unrelated subject, namely, the allocation of resources to projects which do not have any immediate benefits. The writers asked if "we can slight or abolish certain scientific research projects on an exploratory nature which are still at the experimental stage and do not appear to have any practical use for the time being but are of far-reaching significance? "

[43] Science and technology progress report, *Peking Review*, 1973, No. 1.

[44] Stefan Dedijer, "The East Is Read," Nature, Aug. 21, 1975, vol. 256, Boel Billgren, No. 5519, pp. 608-610.

The struggle over policy and the politicization of institutes could do nothing but disrupt scientific research—one of the effects being that scientists had little time over for research. Consequently, the circular announcing the national science conference to be held in spring 1978 declared that "just as we insure the time for the workers and peasants to engage in productive labor, so the scientific research workers must be given no less than five-sixths of their work hours each week for professional work." [45]

The Physics Institute of the Academy of Sciences is one of the first institutes to announce that the principle is implemented. The party committee says that it has taken effective measures to insure that scientific research personnel devote at least five-sixths of their work hours each week to scientific research.

The dual character of China's science and technology system will remain particularly in rural areas where the needs of agriculture requires a system which in many ways must be different from that serving the modern large-scale industry.

Today the Chinese countryside has a four-level agricultural scientific experiment network which originated in the great leap forward in the late fifties but has essentially been developed since the late 1960's. This network is composed of agricultural science institutes at the county level which in collaboration with higher level agricultural scientific institutes form what the Chinese call "the backbone." The other three levels are stations, teams and groups at the commune, production brigade, and production team levels respectively.

In recent years there has been a considerable expansion of the agricultural scientific experiment network which is reported to cover over half of the counties, communes, brigades and teams in the country. This information is not very precise but we have been told that 14 million people are participating in the work of the agricultural scientific research organizations. On the basis of such information we have calculated that the manpower within this network contributed 6 percent of the total R. & D. budget in 1973 and around 10 percent in 1976.

The network is playing an important role in promoting agricultural development and also include forestry, animal husbandry, sideline production and fisheries in addition to farm crops. However, one should realize that the importance of the network lies as much in solving production problems as solving problems encountered in research. In sum, the networks value lies in its ability to—jointly with professional agricultural science workers—gather data, study the breeding and cultivating techniques, and finally popularize the seeds over large areas. An illustration of the magnitude and complexity of the agricultural scientific network is given in tables 10 and 11 which are based on data collected when the author visited China in 1973.

Few visitors knowledgeable about the problems of developing countries have questioned the value of breaking the elitism and conservatism of China's scientists and bringing them into closer touch with the environment they are serving. But a number of visitors have pointed out that the Chinese method of accomplishing these goals may, momentarily at least, have taken a heavy toll on first-class in-depth research.

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[45] C.P.C. Central Committee Circular on Holding National Science Conference (Sept. 18 and 19, 1977), *Peking Review*, 1977, No. 40.

In his estimate of China's R. & D. expenditures in 1965 Leo Orleans states that "whereas political and social changes have permeated throughout the population, large segments of the rural population are still untouched by technological change.[46] This may by and large have been true before the cultural revolution, but changes since then have considerably transformed the rural sector.

It is the characteristics of a basically different R. & D. system and the involvement of very large numbers of people rather than traditional R. & D. budget estimates that is the key to understanding R. & D. in rural China.

This is only one aspect of today's manpower with a very heavy emphasis on rural development and mobilization of large numbers of young people for technical transformation. This is evident from the fact that since the beginning of 1973 2 million educated youth have every year been transferred to the countryside for a more or less permanent settlement. This corresponds to roughly 50 percent of school-leavers in urban areas for the past 4 years. Similarly, the relatively small enrollment and slow expansion of the traditional universities should be compared with the expansion of correspondence education and the development of the workers' colleges. The latter have increased from approximately 1,200 units with an enrollment of 90,000 in June 1975 to 15,000 units with 78,000 students 1 year later.

But there are also problems associated with the rapid development of regional science and mass science in agriculture. The emphasis on self-reliance and the three-in-one groups of scientists, technicians, and peasants has no doubt improved the efficiency of the agricultural extension service in China. But Dwight Perkins points out with reference to information collected by a U.S. plant studies delegation in 1974 that this new approach has cut heavily into high level research.[47] He uses an example from the Kirin Academy where out of the 450 staff members, one-third was spending a year working on production problems at "basic points" and the other two-thirds divided their time between work in the academy and extension work in communes that did not have "basic points."

The delegation noticed that the field research, being observed, was largely straightforward variety testing. There was no sophisticated field research and there was also the question whether the Chinese were training sufficient numbers of highly qualified younger plant scientists. The members of the delegation also saw a problem in China being cut off or having only limited contacts with the work of agricultural scientists elsewhere in the world and also indicated thas there may be little contact between plant scientists in different regiont within China.

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[46] Leo Orleans, "Research and Development in Communist China: Mood, Management and Measurement," in "An Economic Profile of Mainland China," U.S. Congress, Joint Economic Committee, Washington 1967.

[47] The information in the following paragraphs is mainly based on Dwight Perkins, "A Conference on Agriculture," China Quarterly, No. 76, September 1976.

Given these shortcomings a member of delegation suggested, that:

> If you could hybridize the Indian and Chinese agricultural research and extension systems, you would have a very good system. India now has some very sophisticated research capacities and is very poor between the research organizations and the farmer. Between them and the farmer they are weak whereas between such organizations and the farmer China is strong. But China doesn't have anything behind it. Both of them have great gaps and the Chinese system has a great gap in the more sophisticated work. It is probably easier to create the research part once the extension part is in place, however, than vice versa.

Most of the members of delegation did not doubt that the Chinese could solve the problems referred to here, if they wanted to. However, there was some doubt that the Chinese political authorities were not interested in moving in that direction—at least not for the time being (1974). In the changes now undertaken in China we see that many or all the problems indicated here are being observed and remedial changes are being implemented.

Popularizing science will remain an important element in China's science and technology policy. This comes out very clearly in the C.P.C. Central Committee Circular on Holding National Science Conference in spring 1978. Here it is stated that "the agro-science network embracing the four levels of the country, commune, production brigade and team and the technical innovations organization should be strengthened and improved."

Combining the professionals and the masses is seen as one of the measures to implement the new science and technology plans Chien Hsueh-sen in his earlier Red Flag[48] article mentions that Taching, the well-known combine of oilwells refineries and petrochemical industries, has a four-level scientific research network and that a four-level research network also exists in agriculture. So, he argues, it is even more necessary that the whole nation should have scientific and technological networks with level-to-level division of work and coordination. (See figure 1) and he goes on to say that scientific and technological workers must include university, middle and primary school teachers and students. He also sees an expanded role for the China Scientific and Technical Association, other professional and mass organizations which should assist state scientific organizations.

Another feature of mass scientific experimental activities in China are the scientific and technical exchange stations. Such centers were in 1976 reported to have been set up in 142 cities—all of them established since the cultural revolution. The Shanghai Science and Technology Exchange was founded in 1970 and had 1,400 members 6 years later. Eighty percent of them were industrial workers while the rest were engineers, technicians, research workers and teachers at institutes of higher learning. The exchanges have a number of teams depending on the needs and specialize in such fields as electronic computers. The members are aside from courses active through the cities. They organize innovators in various branches of industry, conduct scientific experiments on a mass scale and publicize information about new techniques.[49]

In 1976 the system of scientific and technical exchange stations engaged altogether 1,200 scientific and technical teams with a total of 54,000 people as "backbone" members. Workers made up 70 percent for the country as a whole with the remainder being cadres and technical personnel. This contingent of amateurs is said to take the lead in carrying out mass scientific and technical activities in the cities. Cutting across the various trades, the stations organize technical innovations activists from different factories and enterprises. Apart from exchanging advanced techniques, they also work in co-ordination to solve key problems in production, train "backbone" technicians, and popularize scientific knowledge by translating it into plain language and lively forms.

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[48] Chien Hsueh-sen's *Red Flag* article on science and technology, BBC FE/5563/B11/6.

[49] "Workers in Science and Technology," the Shanghai Science and Technical Exchange, China Reconstructs, vol. 23, No. 11 (November 1974). Dissimination of new techniques, NCNA in English, Aug. 26, 1976. BBC Summary of World Broadcasts FE/W894/A/12.

However, the exchange stations may have been closely associated with the technology policies of the "gang of four" and play a much reduced role today. There can be no doubt that they were occasionally in conflict with the local associations for science and technology, which were more professionally inclined because of their membership. At the same time the emphasis of the exchange centers may have led to a relative neglect of the exchange of scientific technical information at a somewhat higher professional level. This becomes clear when reading reports that people in autumn 1977 have crowded the auditorium of the Ministry of Metallurgy in Peking to hear academic reports presented every Saturday afternoon. The meetings have been attended by ministers, vice-ministers, scientists, and technicians as well as political and administrative personnel. The meetings, which were started in September 1977, have been sponsored by the China Metal Sciences Society and supported by the Ministry of Metallurgy. The reports during the first few months covered topics such as the iron and steel industry in the United States and Japan, advanced iron smelting, steel refining, and steel rolling techniques in the world. A number of the research institutes under the ministry are reported to have started to hold similar report meetings. In the news report it is pointed out that the meeting hall is filled to capacity every time a meeting is held in the ministry because the lecturers are—with reference to "let a hundred schools contend"—allowed to express their own views.[50]

High-level technology, advanced scientific research and the professionals in China are today coming back in their own right. What effect, if any, does this have on the mass science network which—as can be seen from the earlier pages—is of an impressive scale. In order to get a proper perspective we have to recognize that mass science can serve two very different functions. First, it can be used as a political instrument in order to substitute and downgrade the professionals and all intellectuals. Second, mass science can be used to complement the professional sectors where scarcity or noncompetence require additional resources. Instances of the first approach will lead to the elimination or a different emphasis on mass science and this problem is discussed at some length in connection with education and the role of the intellectuals education and open door research.

In the second approach it is possible to distinguish a number of different justifications and the more important are the following ones. Employing large numbers of mass scientists can be justified in collecting huge amounts of data or carrying out experiments on a large scale where high-level training is not really required. Thus, new knowledge can be created with a more efficient use of available resources. Using large numbers of people in agricultural research and popularization is a good example of this approach which may be further justified by the fact that trained manpower is not available and time is short. Involving large numbers of people of creating new knowledge—adapted to the local situation—has another benefit. It makes it, in most cases, easier to implement decisions where it is essential to make use of the new knowledge—introducing intercropping for example. Finally, the educational effect must not be forgotten as very large numbers of people are being trained in logical reasoning and scientifically controlled experiments—and acquiring an awareness of knowledge which we take for granted in advanced countries.

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[50] Ministry's Academic Report Meetings, NCNA in Chinese, Dec. 13, 1977, BBC FE/5695/B11/17.

However, it is at all times necessary to strike a correct balance between the professionals and the people being mobilized in mass science. That a new balance is needed comes out clearly in a People's Daily editorial discussing earthquakes.[51] The article stresses that it is possible to obtain more information and scientific bases for analyzing forecasting earthquakes if the masses can master certain knowledge. Pooling the efforts of the masses in observing and preventing damage caused by earthquakes is especially important because difficulties still exist in forecasting earthquakes. On the other hand the article also says that the seismological departments, in order to push scientific research, must formulate plans for developing seismological science and technology, readjust and strengthen scientific research institutes. Further, it is necessary to restore the technical job titles of personnel in seismological science and technology, establish an evaluation system and implement the system of personal responsibility in the field of technology.

EDUCATION

China is, as many developing countries, facing an educational dilemma. On one hand, it is necessary to insure that the benefits of education reach down to the broad masses of the people. On the other hand, it is equally important for a country aiming at rapid industrialization to have a wide range of highly qualified professional cadres. These two different needs, equally urgent, have in recent years not been reconciled. The consequences appear to have been that the training of specialists and the university system were neglected. So institutions for training of engineers and scientists will now have to expand considerably if the desired high rate of growth in industrial and agricultural production is going to be realized.

Another major issue is the still lagging universal education, and the lower rate of literacy in higher age groups. This makes it necessary to rely extensively on nonformal education in order to supplement the normal programs. And a practical-oriented primary education is necessary in order to develop rural areas where the majority of the population is still to be found in order to support programs for increased productivity in agriculture and in order to promote equality.

The development of China's human resources must be multifaceted in approach. Here, a choice has been made to focus the discussion on two aspects—university education and postgraduate studies—which we consider to be of basic importance for China's development strategy and only summarily deal with primary and secondary education. However, China's dual sector development strategy will require great changes both in rural areas and in the modern industrial sector and new educational needs will have to be met both through developing primary and university education.

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[51] *People's Daily* editorial on seismology, Dec. 21, 1977, "Raise Seismological Science and Technology to a New Level," BBC FE/5701/B11/1.

Primary and Secondary Education

An attempt will be made here to indicate the effect of the expansion of primary education. It has been estimated that the number of persons among the working age population 15–64 years with completed primary education was 160 million in 1970.[52] This figure may seem somewhat low but it must be remembered that 85 percent of the population continues to live in rural areas and that schooling has in the past not been made available to all children. However, it should be noted that the literacy rate may be considerably higher due to large scale attempts to raise the educational level through literacy campaigns. We now make the following assumptions in order to arrive at an estimate of the number of persons having completed primary education in 1990. First, those entering working age groups in 1971–75 have 60 percent completed primary schooling, in 1976–80 80 percent, in 1981–85 90 percent and in 1986–1990 100 percent. The underlying assumption is then that primary education will become universal, even in rural areas, within the next few years.[53] The number of people having completed primary education would under these assumptions have reached approximately 450 million which is slightly over 60 percent of the working age population in 1990 against only 35 percent in 1970. See table 4.

TABLE 4.—EFFECT OF EXPANDED PRIMARY EDUCATION IN CHINA

[Number in millions]

Period	Yearly number of people entering working age	Received primary education (percent)	Total increase for period	Accumulated number
1970				160
1971–75	16	60	48	208
1976–80	17	80	68	276
1981–85	18	90	81	357
1986–90	19	100	95	452

The figures for the working age population having received primary education have been inserted into figure 2 [54] which also gives China's total population in age groups over the period 1965–2000.

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[52] Leo A. Orleans, "China's Science and Technology Continuity and Innovation," Joint Economic Committee of Congress, People's Republic of China: An Economic Assessment, Washington, 1972, p. 217.

[53] In an article prepared by PRC contributor UNESCO reports that "about 90 percent of school-age children are now attending school" which it is assumed relates to primary education only. The educational revolution, by Yong Hong in "Prospects," vol. V, No. 4, 1975, p. 481.

In early 1976, the Chinese news agency had the following to say about primary education: "Universal 5-year primary school education has been achieved in the main throughout the vast countryside of China. By the end of 1975, well over 95 percent of school-age children in the country had been enrolled as against 84.7 percent * * * in 1966 and primary school attendance had increased by 30 percent." (News from Hsinhua Weekly, issue No. 362, London, Jan. 15, 1976.)

[54] Sigurdson, Jon. Comments on China's industrial and technological potential in 1990, 96 pages. Stockholm, 1975/National Defence Research Institute/Revised, unpublished version 1976.

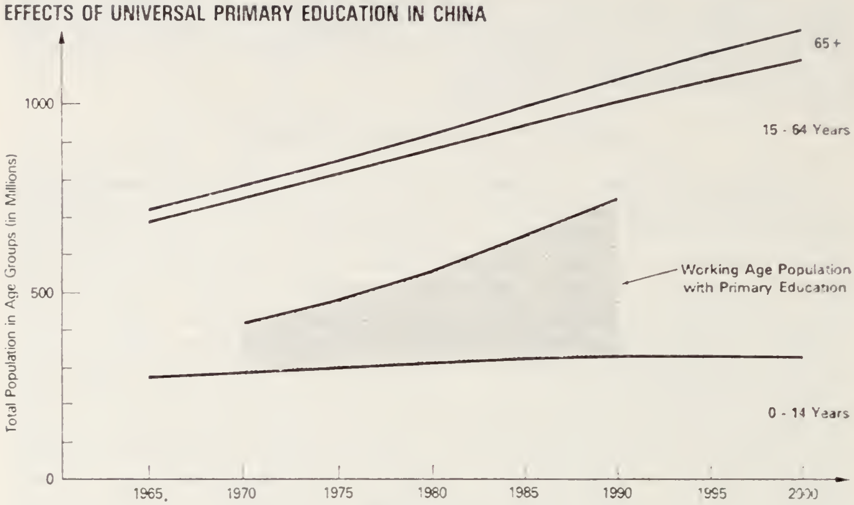

FIGURE 2

The fact that only 60 percent of the working age population would have received primary education in 1990—within the traditional educational system—clearly points to a continuing need for various forms of adult education. This was early realized and there is every reason to believe that adult educational policies will be important in China's rapid economic transformation.

Expansion of primary education will have a number of effects influencing China's economic development. First, China's manpower will be increasingly better educated. Second, given the emphasis of combining theory with practice the educational expansion is likely to have a very positive effect on productivity. Third, most of the educational expansion takes place in rural areas as primary education is already universal in city areas, and consequently gives the countryside a strong impetus for economic development.

The enrollment in the primary and secondary sectors of education is given in figure 3 based on figures in table 5. As a rough estimate we have assumed that total enrollment in state-run universities is around 0.5 million. Consequently, only a minute fraction of a year group today goes on to higher education. There can be no doubt that China has large reserves of human talent—untapped for university and college education. Consequently, there does not appear to exist a problem in finding university entrants which are both talented and ideologically motivated.

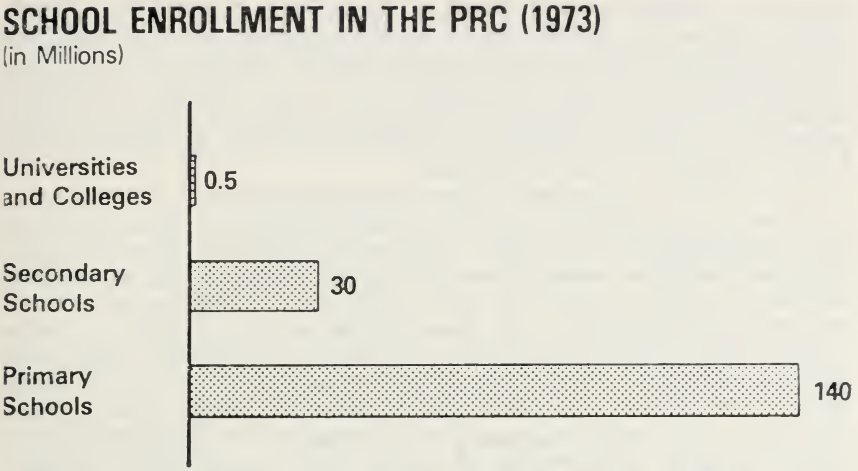

FIGURE 3

TABLE 5.—ENROLLMENT IN PRIMARY AND SECONDARY SCHOOLS IN THE PRC[1][2]

	Primary school enrollment	Secondary school enrollment
Preliberation peak	24.00	1.49
1949	24.69	1.04
1958	86.4	8.52
1966[3] total	(116)	(14)
1973[4]	136.80–140.73	23.92–34.27

[1] It has been reported that "Junior secondary schools are widespread in cities as well as in some of the rural areas. Senior secondary education has become almost universal in big cities. The number of secondary school students in 1973 was 23 times that before liberation, and primary school enrollment increased 5.7 fold." Primary and secondary education, by Hsin Wen, in "Prospects" (UNESCO), vol. 5 (1975), No. 4, p. 485.

[2] If we now turn to the statistics in "Ten Great Years," Foreign Languages Press, Peking 1960, we get the following information: "In 1958 . . . while the students in middle schools numbered 8,520,000 8.2 times the 1949 figure and 5.7 times as many as in the preliberation peak year. There were 86,400,000 primary school pupils in 1958, 3.5 times the number in 1949 and 3.6 times the preliberation peak." Surprisingly it is also stated: "In 1958, universal primary education was put into effect in many counties; 85 percent of all school-age children were in school in the country as a whole."

[3] A Red Flag article (December 1977) reports that by the time the cultural revolution started . . . total enrollment at schools of different categories at different levels had come to 130,000,000. The estimates in the table are made on the assumption that ordinary primary, secondary schools, and institutions of higher learning are included (Hsinhua, Stockholm, 1977, No. 278).

[4] The variations are due to the fact that the article in the "Prospects" does not clearly indicate if the base year is 1949 or a preliberation peak year.

A draft program for a tentative implementation of the full-day, 10-year primary and middle school teaching system—

Stipulates the tasks, schooling system, and basic principle for the formulation of teaching plans for primary and middle schools, the time for "principal studies" and "subsidiary studies" and the complete range of activities and institutions of courses in these schools. Full-day primary and middle-level schooling calls for 10 years of schooling—5 for primary school and 5 for middle school. Of the 5 years at the middle school level, 3 are for junior classes and 2 for senior classes. All students will begin the school year in the autumn, in those localities where conditions permit, enrollment of children at the age of 6 or 6½ may be practiced step by step.[55]

However, in education China will pursue a two-leg policy and simultaneously strive for "popularization and higher standards." This means that there will be full-day schools, work-study schools and spare-time schools as well. Most of the primary and middle schools in the rural areas are still practicing the 9-year school system which will gradually be turned into full-day 10-year schools. Until then the teaching programs may be formulated by the respective provinces, municipalities, et cetera. However, full-day schools with a 10-year program must improve school management and have "the top three leaders installed as soon as possible."

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[55] "Education Ministry's Programe for Full-Day, 10-Year Schooling" [NCNA, Feb. 12, 1978], BBC FE/5742/B11/17.

Since the late sixties more than 16 million educated young people have been transferred from cities and towns and more than 10 million are still working in rural areas and frontier regions.[56] As a provincial example Kweichow reports that "(I)n the past 10 years or so, 200,000 educated young people from various cities and townships . . . have gone to the countryside." Of these 110,000 are still working in agriculture while others have been transferred to industry, and communications, finance and trade or enrolled in cultural and educational activities.[57] There is no doubt that these educated young people represent a large still untapped pool of resources for the development of the Chinese countryside. However, they must receive further education and training and that was one of the themes of a national conference at the beginning of 1978. The meeting decided that spare-time education network will be set up for which the departments of education will be responsible. Other departments like agriculture, machine-building, scientific research, and public health should also lend a hand in training them and utilize their talents by giving technical guidance and providing special technical training. Publishing houses will also care for their special requirements in reading material.[58]

The expansion and improvement of the educational system naturally has consequences for the training and allocation of teachers. Available information so far has only contained information about teachers in the middle and elementary schools which comprise the 10 years of schooling before university entrance.[59] It is being complained that teachers, in the past, were on loan or transferred to other organizations. The inevitable result was that replacements were not available and that teaching positions were filled by nonteachers. According to a new directive the management of schools will now be under education administrative departments with the party committees exercising centralized leadership.[60]

In order to deal with the apparent shortages all graduates from the teachers' schools will now be assigned to educational posts. A related measure is the instruction that teachers, as well as students, should engage in industrial work, farming and social and political activities in the time set aside for self-study during part of their vacation. This will then "insure that teachers devote five-sixths of their time to teaching," which is identical to the ratio given for the work performed by scientist.[61]

The same directive also discusses the commune-run schools which are likely to provide a lower quality education for some time to come. Here it is mentioned that teachers should be selected "in accordance with the actual needs for developing education and with the guidelines for maintaining the rural labor force." This is likely to mean a stronger emphasis of intellectual qualifications and the teachers must pass an examination which is set by the education department of the county administration. It is also indicated that it will be difficult to change jobs without approval of communes and schools.

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[56] Training of middle school graduates settled in the countryside discussed at national meeting (Peking, Jan. 24, 1978), Hsinhua News (Stockholm), 1978, No. 21.

[57] Kweichow conference on rusticated young people (Kweichow Provincial Service, Feb. 21, 1978), BBC FE/5749/B11/16.

[58] See footnote 56.

[59] The total number of teachers, of all categories, is reported to be 10 million.

[60] State Council Approves Education Ministry's Recommendation on Teachers, NCNA, Feb. 5, 1978 BBC FE/5737/B11/8.

[61] *Ibid.*

University and College Training

All countries, especially developing ones like China, have to face the challenge of training technical personnel—in appropriate numbers—to meet the various industrial and other requirements. The system of education must be coherent in order to train engineers, technicians, and other types of middle-level personnel not only in required numbers but also at the appropriate level. It should be noted here that very large numbers of people in China are being trained in industrial technology in the numerous rural industries.

However, advanced technology will require more high-level technicians for the following three tasks. First, to operate and maintain the new plants. Second, to evaluate, adapt designs and duplicate the imported technology through production in Chinese machinery plants. Third, to carry out research and development of equipment and machinery to replace what is now imported or in the near future duplicated in China. The first two points increase the demands on the universities while the third raises further demands on university research as well as research institutes.

It has often been argued among foreigners that China reduced her potential for industrial and technical development when the universities were closed for a number of years during the Cultural Revolution. The stress on economic, industrial, and technological development derived from the four modernizations, no doubt, will greatly increase the demand for university-trained people. The long lead time required in the educational preparation of, for example, engineering personnel demands that estimates of the requirements be made 5 to 10 years in advance. So, the earlier debate on length and content of the engineering curriculum and recruiting principles clearly indicated that the industrialization must have been hindered. However, we will first argue here that an excess number of university graduates in 1966 made it possible to temporarily close the universities and not until recently has there been an urgent need to provide new additions to the stock of engineering personnel.

College and postgraduate students form one of the basic assets in the development of science and technology. The leadership in China has stated that "the quality of the new students enrolled by institutions of higher education has declined year after year, resulting in a gap in the training of scientific and technical personnel." Another criticism is that since the educational level of the students was low and their standards different, it was difficult for the teachers to teach and difficult for the students to learn. At a national conference on student enrollment held by the ministry of education [62] in autumn last year we were told that "the work of enrolling students for institutions of higher learning is directly related to the quality of high-level specialists being trained," and that it "affect middle and primary school education."

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[62] Ministry of Education's National Conference on Student Enrollment, NCNA, Oct. 20, 1977, BBC/FE/5648/B11/1.

We will now use findings from India in trying to relate the stock of, and demand projections for engineering personnel to the expansion of the Chinese economy.[63]

An Indian study [64] reveals that the output/engineer ratio decreases as the economy expands. The same holds for the investment/engineer ratio although the rate of decrease is much slower. However, the engineer/work force ratio increases quite rapidly. Unfortunately, we have no estimates for the investment and the work force in China and we will consequently focus on the output/engineer ratio. We have no reason to believe that the Indian economy should be structurally so different that it would invalidate our analogy.

We have in table 6 presented the number of the graduates in engineering and natural sciences year by year since 1949.[65] The accumulated number is calculated based on the yearly figures. Further, the table gives an index series for the number of graduates (100 in 1957). Table 6 also includes an industrial production index, based on a recent study of the Chinese economy (100 in 1957).[66] Further, the index series for industrial production has been projected up to 1990—assuming growth rates ranging between 8 and 12 percent.

TABLE 6.—RELATION BETWEEN GRADUATES IN ENGINEERING AND NATURAL SCIENCES, AND INDUSTRIAL PRODUCTION IN CHINA

Year	Graduates thousands	Accumulated		Industrial production (Michael Field index)
		Thousands	1957 index=100	
1949	6.3			
1950	6.2	12.5		
1951	5.9	18.4		
1952	12.4	30.8		
1953	16.3	47.1		
1954	16.4	63.5		
1955	20.6	84.1		
1956	26.0	110.0		
1957	20.7	131.0	100	100
1958	22.1	153.0	117	145
1959	(27.7)	181.0	138	177
1960	(57.9)	239.0	182	184
1961	64.0	303.0	231	108
1962	70.0	373.0	285	114
1963	87.0	400.0	351	137
1964	86.0	546.0	417	163
1965	73.1	619.0	473	199
1966	73.1	692.0	528	231
1967	5.0	697.0	532	202

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[63] Engineers are concerned with design, construction and production and application of fundamental scientific knowledge to the problems of the physical world. Under the direction of engineers, technicians of various types supervise/perfom a wide range of field operations in production and construction, testing and development, installing and running engineering plant, drafting and designing products, estimating cost and selling and advising customers on the use of engineering or scientific equipment. Often the technician acts as liaison between engineer and skilled craftsman. It is his job to interpret the engineer's plans and designs, to determine the production and construction techniques to be used and to choose the tools and machines best suited to the job. He is also responsible for a host of other semiprofessional functions, that he carries out on his own initiative and under the general supervision of a professional engineer or scientist.

[64] "Engineering Manpower" a sectoral study of engineering manpower requirements up to 1976, based on output, investment and workforce, Institute of Applied Manpower Research, IAMR Report No. 1/1967, New Delhi, 1967. The methodology and new figures are further discussed in: "Engineering Occupations in the Fifth Plan," IAMR Report No. 1/1974.

[65] Joint Economic Committee of Congress, "People's Republic of China; An Economic Assessment," Washington, 1972, p. 219.

[66] "China; A Reassessment of the Economy," a compendium of papers submitted to the Joint Economic Committee, Congress of the United States, Washington, D.C., 1975.

TABLE 6.—RELATION BETWEEN GRADUATES IN ENGINEERING AND NATURAL SCIENCES, AND INDUSTRIAL PRODUCTION IN CHINA—Continued

Year	Graduates thousands	Accumulated Thousands	Accumulated 1957 index=100	Industrial production (Michael Field index)
1968	10.0	707.0	540	265
1969	15.0	722.0	551	265
1970	15.0	736.0	562	313
1971	35.3	772.0	589	341
1972	35.3	807.0	616	371
1973	76.5	883.0	674	416
1974				432
	Projected index (per year)			
	Plus 8 percent		Plus 10 percent	Plus 12 percent
1975	467		475	489
1976	504		523	542
1977	544		575	607
1978	588		632	680
1979	635		696	761
1980	686		765	853
1981	740		842	955
1982	800		926	1,070
1983	864		1,019	1,198
1984	933		1,120	1,342
1985	1,007		1,233	1,503
1986	1,088		1,356	1,683
1987	1,175		1,491	1,885
1988	1,269		1,641	2,111
1989	1,370		1,805	2,365
1990	1,480		1,985	2,648

The starting up of the universities in the early 1970's resulted in a serious political struggle centering on selection criteria, methods, and level of teaching, among other things. The issues have now been resolved. In enrolling new students it has now been clarified that the principle is to select those who are qualified while "insuring an overall balance of moral, intellectual, and physical education".[67] The national system of a unified student enrollment and distribution, practiced before the cultural enrollment will be followed. This also means the method of voluntary application, admission of applicants by the school and approval by the province, municipality, or region. Students are allowed to state two or three choices noting the types of schools they wish to attend and the subjects they wish to major in, according to their interests and attitudes. Twenty to thirty percent of college students will be enrolled from among senior middle school students of the current year.[68]

Some of the more important elements in the new enrollment policy are clarified in the following paragraphs.[69]

> In 1977, major reform has been carried out in the enrollment system for students of higher-learning institutes. The new methods include individual voluntary application, unified examination, preliminary selection by prefectures, municipalities, admission of applications by the school and approval by the province, municipalities, and autonomous regions. All those who are qualified for enrollment, including workers, peasants, educated youth who have settled in the countryside, demobilized military personnel, cadres and graduating high school students, are allowed to apply for the school voluntarily and to choose several schools and different academic subjects according to their own interests and abilities . . . .

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[67] Ministry of Education's National Conference on Student Enrollment, NCNA, Oct. 20, 1977, BBC FE/5648/B11/1.

[68] "New College Enrollment System." *Peking Review*, 1977, No. 46, p. 16.

[69] People's Daily on upgrading college enrollment, NCNA, Oct. 20, 1977, BBC FE/5648/B11/4.

In admitting students priority will be given to key colleges. Medical colleges, teachers' colleges and agricultural colleges shall enroll barefoot doctors, teachers from people-run schools, and activists in agricultural science and technology. Here it should be observed that, aside from minority students, the enrollment will also include a certain number of young people originating from Taiwan province, young people from Hong Kong and Macao as well as returned young overseas Chinese. After graduation they should obey the unified distribution by the state.

The examinations held in December 1977 were divided into two categories—liberal arts and natural sciences. The first includes political science, language, mathematics, history and geography, while the subjects of the natural sciences examination will be political science, language, mathematics, physics, and chemistry.

Only a small number will be admitted as China's higher education can be far from universal at this stage.[70] In Peking there were more than 100,000 candidates who took the college entrance examinations in December 1977.

Those who sat for the examinations included workers, peasants, educated young people who have settled in the countryside, teachers, barefoot doctors, demobilized armymen, cadres and new middle school graduates as well as a certain number of higher middle school students who are qualified because of their above-average performance at school.[71]

The strong desire and interest for university education can be understood by looking at the numbers. In the country as a whole 5.7 million young people took college entrance examinations and less than 200,000 are likely to have been admitted.[72] At the time cf college entrance examinations students also sat for examinations to enter secondary schools—both technical and in other professions. At least another 10 million are likely to have sat for secondary school examinations. At the end of February 1978 the new students have started to enter their colleges and universities. There can be no doubt that intellectually highly qualified students have seen selected while at the same time stressing the family background and a proper distribution from all over the country. At Peking University for example more than 70 percent of the students are reported to be "children of workers, poor and lower middle peasants, and revolutionary intellectuals".[73]

The geographical principle in recruiting students can be illustrated with the example from Tsinghua University—which is China's leading technological university—where the 800 new students come from 22 of China's 30 provinces and regions including Peking, Shanghai, and Tientsin. Twenty-five were selected from Anhwei which has roughly 5 percent of China's population.[74] The key colleges in which group Tsinghua University belongs have been given first priority in selecting students in order to guarantee a high standard of students.[75]

The different selection criteria can also be seen from the age level of the students—again exemplified from Anhwei. Here it is mentioned that Anhwei Labor University and Normal University paid attention to selecting students who graduated from senior secondary schools in 1966 and 1967.

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[70] Hsinhua Weekly, issue 462, p. 8.

[71] Hsinhua (Stockholm), 1977, No. 297.

[72] The Educational reform and the prevention of elitism. Excerpts from interview with a leading member of the Ministry of Education [NCNA, Feb. 11, 1978], BBC FE/5739/B11/2.

[73] China's new college students begin school [Peking, Mar. 3, 1978], Hsinhua News [Stockholm], 1978, No. 55.

[74] Anhwei student enrollment [Anhwei Provincial Service, Feb. 5, 1978], BBC FE/5739/B11/6.

[75] See footnote 73.

Consequently, these students are around 30 years which may be appropriate for certain types of training. On the other hand, the average age of the students selected from Anhwei by the prestigious Chinese University of Science and Technology is only 19 with 15 as the youngest and 22 as the oldest.[76]

In discussing the future of China's science and technology, Fang Yi also indicated the country's training and educational needs. For a vast country like China it is necessary to train a professional contingent of several million people whose level is above that of university graduates.

If we assume a yearly enrollment in colleges and universities in the region of 150,000 this would correspond to approximately 1 percent of the relevant age group. We now assume that university enrollment should keep pace with the assumed 10 percent increase of industrial production, approximately equal to the rate of expansion of the modern sector of the economy. By 1990 yearly enrollment would then have increased to approximately 690,000 which would correspond to roughly 3.5 percent from a base of approximately 20 million. Total university enrollment would then be about 2.8 million if we assume an average period of study of 4 years.

Accepting projected rates of industrial growth to be between 8 and 12 percent, given in table 8, clearly shows that a very large number of engineering and natural sciences graduates, not counting other categories, have to be trained. Simplistic calculations indicate that China will have to train 2 to 4 million graduates in the period up to 1990 in order to cope with the expected demand for engineering and scientific talent within the industrial sectors, assuming the output/engineer ratio to be unchanged. In the light of the Indian experience with a declining output/engineer ratio it appears likely that the figures should be revised upward. Further, no corrections have been made here for attrition and the required numbers are consequently still higher.

This would indicate that enrollment will have to increase considerably in existing institutions. It would most likely mean that a number of new institutions of higher learning will have to be created. By the time the cultural revolution started, the number of China's institutions of higher learning has grown from the more than 200 in the early days after 1949 to well over 400.[77]

Of the more than 400 institutions of higher learning the Ministry of Education has recently decided to list 88 as key or pilot universities for the country as a whole.[78] Sixty units already had this position before the cultural revolution while the rest are recent additions to the list. Under this program, a number of representative universities and colleges will enroll "students with a superior educational level." Such schools will have more competent faculties, better teaching facilities, and the state will also give additional support for reference books and teaching equipment. The emphasis to the key units in higher education is said to be justified because it is seen as "an effective means of raising the quality of education (and) to train personnel rapidly." The following universities and colleges are among the key units.

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[76] Anhwei student enrollment [Anhwei Provincila Service, Feb. 5, 1978], BBC FE/5739/B11/6.

[77] A great debate on the educational front, Hsinhua, Nov. 18, 1977, Hsinhua (Stockholm), 1977, No. 278.

[78] Key universities and colleges listed, NCNA, Mar. 1, 1978, BBC FE/5754/B11/13.

1. Peking University.
2. Futan University in Shanghai
3. Nankai University in Tientsin
4. Nanking University
5. Shantung University
6. Sinkiang University
7. Tsinghua University in Peking
8. Chiaotung University in Sian
9. Tungchi University in Shanghai
10. University of Science and Technology
11. Peking Aeronautical Engineering Institute
12. Taching Petroleum Institute
13. Yunnan Forestry Institute
14. Kiangsi Communist Labour University
15. Tachai Agricultural College

The principle of key schools is not limited to the university system. At the beginning of 1978 the Ministry of Education issued a circular on a tentative program for running key primary and middle schools throughout the country.[79] Some of the key schools will be in towns while others will be in the countryside. Schools run by the industrial, transport, and communications enterprises will also be designated as key units. Here the stress will be on teaching basic knowledge related to the subjects in for example metallurgy or geology departments and such students are also expected to do a certain amount of productive labor. The concerned educational departments expect to map out plans for their localities. In the first half of 1978 the leadership of the key units will be strengthened which also applies to the teaching staff. The key primary and middle schools will also be given financial assistance for such things as reference material and other teaching material.

It may be realistic to assume that college and university education will expand faster than industrial and economic growth. If we now assume a yearly annual enrollment increase of 15 percent, the yearly intake would, by 1990, have risen to 1.4 million. This would then correspond to 7 percent of the relevant age group and total university enrollment would amount to 5.6 million. It should also be noted that the yearly university enrollment in 1990—assuming a yearly increase of 15 percent—would correspond to at least 35 percent of the relevant age group residing in urban areas. In a country of China's size and with her development situation it is of paramount importance not to allow the city elites to monopolize university education.

Due to the limitations of educational facilities only a small number of young people will be able to enter state-run colleges. The broad masses of young people, workers, and peasants will have to rely on other types of schools to acquire and raise their scientific and cultural knowledge.[80] The July 21 workers colleges are run by industrial enterprises and mines and May 7 colleges are training workers for rural construction. Both types of schools will draw their student body from experienced workers and peasants who are seen as an important source for the training of China's future scientific and technical personnel.[81]

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[79] Ministry of Education circular on primary and middle schools [NCNA], Jan. 26, 1978, BBC FE/5725/B11/6.

[80] People's Daily on the need for variety of educational institutions, Dec. 7, 1977, BBC FE/5688/B11/17.

The number of graduates trained annually by the ordinary state-run universities is still very limited. The 21st July workers' universities, operated by localities since a couple of years, have partly made up for the shortage of graduates colleges and universities and filled vacancies in the technical force at plants, mines and other enterprises. The state council's industrial departments and some provincial, municipal and other regional industrial departments have now formulated plans for the training of technical personnel over the next 3 to 8 years, until the end of the fifth 5-year plan (1980) and sixth 5-year plan (1985) respectively. According to these plans more than half of the training tasks have been assigned to the 21st July workers universities and other schools operated by the plants themselves.[82]

The simultaneous development of rural areas and agriculture in harmony with the urban areas and industry may pose problems in education. No doubt, a balanced development is likely to bring short term costs which, however, are more than compensated for in the long run. However, the leadership argued since the cultural revolution that the same educational system could serve both sectors. This is somewhat surprising in the light of very different policies with regard to technology requirements. The refusal to accept a differentiation in the educational system can no doubt be found in the fear that new elites—a new class—would emerge in China.

This brings out a serious dilemma for the Chinese leadership. On one hand, it is for obvious political and economic reasons necessary to pursue a balanced economic development. However, the economic importance of the modern industrial sector now and in the future will require differential policies with regard to education, incentive systems, etc. which if fully implemented may tend to undermine the policies of a balanced growth. There appears to be no easy way out of this dilemma.

Postgraduate Training

The enrollment of postgraduate students is an important measure for accelerating the training of scientific and technical talent and for realizing the "four modernizations" at an early date. These views were stated in a recent "circular on specific methods of enrolling postgraduate students in 1977" which was issued jointly by the Chinese Academy of Sciences and the Ministry of Education. The circular calls on concerned departments to assist all units in doing a good job in registration, examination, evaluation, and selection of postgraduate students. The academy and all schools of higher learning have begun to enroll students. The period of study will generally be 3 years. The age of those selected from universtiy graduates must not exceed 30 while others may be admitted up to the age of 35.[83]

From people within the Chinese Academy of Science it has been pointed out that the reinstitution of the postgraduate system is very important for correcting a situation where China has only a limited number of scientific research workers and with low proficiency levels.[84] In order to advance the country's science and technology it is very important to quickly train proficient personnel.

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[81] "China Holds National Conference on College Enrollment", Hsinhua, Oct. 21, 1977.

[82] Fu Chun, an important method for training competent people—a comment on the need for plants and enterprises to run the 21st July workers universities well. (NCNA, Dec. 17, 1977). BBC FE/5700/B11/5.

[83] Enrollment of post-graduate studens NCNA, Nov. 15, 1977, BBC FE/5673/B11/12.

The attempts to regularize postgraduate training has been going on for some time. Following Chou En-lai directives on the study of basic theories in 1972 Tsinghua University in Peking for example set up six postgraduate classes, increased lectures on basic theories and began improving laboratories.[85] At the time, Chou En-lai also called for the enrolling of a part of the college students from among the new senior middle school graduates of the year. The national conference on college enrollment in autumn 1977 noted that students going on directly from one level to another is important in training scientific researchers at a faster rate and in the study of basic theories of natural science. This is particular important in light of the view now held in China that the political struggle in research years "created a serious gap in the reproduction of scientific and technical personnel in all fields * * *" [86]

In recent years, the enrollment for training of research students has been more or less disrupted. So, the number of students admitted in winter 1977–78 will exceed any previous years which ranged from 1,000 to 3,000 during the period from 1949 up to the Cultural Revolution in 1966. All universities, colleges, and institutes of the Academia Sinica have made preparations. The Graduate School of the China Science and Technology University plans to enroll 1,000 postgraduate students within the next 2 to 3 years and then gradually increase the number.

The postgraduate studies at the China Science and Technology University will usually last for 3 years.[87] After the first year the students will work at various research institutes under the Chinese Academy of Science in the Peking area. They will then be under the supervision of instructors who are research workers or assistant research workers. Simultaneously they will be studying theories and engaging in practical research on specialized subjects, and before graduation, independently complete a scientific research project. The graduation project will be evaluated by the Graduate School together with the academic committee of the various units concerned. More than 200 specialities, later on increased to 300, are offered to graduate students by the Chinese Academy of Sciences.[88]

A large number of noted scientists are also working in the universities and colleges. Such institutions are seen as an important part of the scientific research work undertaken in China. And 10 to 20 percent of the teaching staff in them are full-time scientific research workers, according to preliminary estimates.[89]

The post graduate courses at the universities will include all the basic sciences, multidisciplinary courses like antipollution and electronic-physics, the latest scientific and technological specialities as well as philosophy and other social sciences.[90] The Chungshan University in Canton, for example, will enroll students in the following specialities: Mathematics, theoretical physics, radio, optics, high polymer chemistry, organic chemistry, entymology, zoology, botany, meteorology, geology, geography, literature, history, philosophy and ancient languages.

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[84] BBC FE/5651/B11/3.

[85] Hsinhua (Stockholm), 1977, No. 300.

[86] China holds national conference on college enrollment, Hsinhua, Oct. 21, 1977.

[87] BBC FE/5651/B11/3.

[88] BBC FE/5688/B11/16.

[89] "Scientific Research in Universities," *Peking Review*, 1977, No. 50, pp. 30–31.

[90] "Chinese Academy of Science and Universities Enroll Fresh Research Students This Winter," Hsinhua, Oct. 22, 1977 (Stockholm 102201).

The new postgraduate enrollment system will accept the following categories of students.[91]

1. Graduates with political awareness and excellent scholastic standing who are physically fit and under 30 years of age—with a maximum age of 35;
2. Undergraduates with exceptionally high scholastic standing or those with scholastic standing equivalent to a university graduate;
3. Fine workers, poor and lower middle peasants and educated youth who have relatively strong abilities in scientific research and who have made inventions or other creations; and
4. Scientific and technological personnel in various offices, young teachers and persons engaged in other work who may voluntarily apply for enrollment and enter only after passing a political examination and other difficult texts.

With a letter of introduction issued by their own units, the candidates should go to the education bureau in their localities and fill out the registrations.[92] These are collected and sent to the units of institutes that the candidates want to enter. The examination will be conducted in two stages. The first examination is held at the end of February 1978 and the second 2 months later. The first examination will include a test on politics, foreign languages, basic subjects and specialty subjects. Candidates will take part in the second examination by showing the letter of notification by the academy. The candidate will also undergo a physical examination and a political review, the latter one by the unit where the candidate resides. Upon completion of this procedure the recruitment units and institutes under the academy will publish a name list of eligible candidates. Notification letters will then be issued by the graduate institute of the Chinese University of Science and Technology to the eligible candidates by May 1978.

The new concern for graduate training is not limited to the hard sciences but it also covers a wide spectrum of social sciences. The Chinese Academy of Social Sciences has announced that it will enroll postgraduates from all the country. The first examinations will be in May and June 1978, and the students will start their studies in September. Among the 10 institutes mentioned are the Institute of Economics and the Institute of World Economy where students will be enrolled in political economy, industrial economy, the economies of the first, second, and third worlds, world statistics—among other things.[93] Related to this is the resumption of "Economic Research", a journal which was suspended for a number of years. It is being edited by the Institute of Economics under the Academy of Social Sciences and the first issue after the resumption appeared in early 1978.[94]

With an expressed goal of increasing the number of professional research workers to 800,000, the postgraduate training at universities and colleges obviously must be rapidly expanded. Tsinghua University in Peking and Chungshan University in Canton, which are both key universities, expect to have 10,000 and 5,000 students respectively in 1985, which more or less corresponds to the capacity of these institutions before the Cultural Revolution. However, there are a number of new elements. Tsinghua University is planning for a postgraduate/undergraduate ratio of 1: 2 which means that Tsinghua would have around 5,000 postgraduate students in 1985. Thus, the university would from then on provide the country annually with about 1,700 students with graduate training assuming that the length of training will be 3 years. The postgraduate/undergraduate ratio at Chungshan University is planned to be 1: 4.[95]

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[91] BBC FE/5651/B11/3.
[92] BBC FE/5688/B11/16.
[93] Social Sciences Academy to enroll postgraduate students (NCNA Feb. 28, 1978), BBC FE/5753/B11/1.
[94] (NCNA, Feb. 19, 1978), BBC FE/5748/B11/18.

As an indication of the order of magnitude we assume that the number of professional research workers is presently approximately 200,000–300,000. The burden of training the research workers must then to a considerable extent fall on the research institutes—under the academies as well as under the ministries. However, two other aspects should also be mentioned. The universities and colleges will recruit day-students which obviously must be recruited from the cities where most of the universities and colleges are located. Furthermore, it is also being contemplated that universities should accept "part-time graduate students." The consequence of all these measures is that the university system will be greatly expanded far beyond the nominal enrollment capacity existing before the Cultural Revolution.

Another indication of the appreciation of academic excellence can be seen in the new institute committees.[96] Some institutes of the Academy of Sciences have recently set up academic committees to make fuller use of scientific and technical personnel. The academy has already taken the formal decision to set up academic committees at the academy and institute levels. Members will be appointed on the basis of understanding the relation between socialism and science, having achieved a certain academic level, and having practical experience and scientific research specialty. The committees will primarily put forward suggestions on the orientation of scientific research, evaluate results and assist in the training of scientific and technical personnel and review progress. Members will be appointed for 3 years by the director of the institute, approved by the institute's committee and registered with the Chinese Academy of Sciences.

Equally important is the exchange of professional knowledge and experience both inside and outside the country. The revival of the Chinese Scientific and Technical Association has meant the revival of academic meetings. As an example the association sponsored an 8-day-long multidiscipline symposium in Tientsin in December 1977 which was the largest in a decade or more.[97] The symposium was attended by 500 people who were members of the societies of zoology, geography, aeronautics, metals, and forestry. Meanwhile the society of automation held a seminar in Peking.

The Chinese Scientific and Technical Association was established in 1958 and now has a membership of 53 national societies dealing with natural science. All the provinces and municipalities also have their own associations with a total membership of about 1,000 societies.

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[95] Information and impressions gained by the author during a visit to China in late March and early April 1978.

[96] Hsinhua (Stockholm), 1977, No. 303.

[97] BBC FE/5673/BII/15.

At a meeting sponsored by the Chinese Scientific and Technical Association to prepare for the national conference it was proposed that Chinese scientists involve themselves in international changes more actively.[98] The Institute of Physics in Peking, which in many ways seems to be at the forefront in implementing the new policies, has already drawn up plans to train researchers by sending them abroad for study and observation.[99]

The importance of using foreign material and being able to utilize such material is stressed throughout the university system. This point may be well illustrated from Chiaotung University in Sian which has the following to say about the subject.

> In order to learn from foreign experience with still better results, we have stepped up collection of reference materials and gathering of scientific and technological information. We demand that all teaching seminars include in their plans of academic activities the study of the development of the related science and technology in other countries and regularly exchange ideas and experience. Additionally, we hold short-term foreign language training classes to enable teacher to read materials in more foreign languages. Students are also required to master one foreign language.[1]

The need for closer relations with the outside world is evidenced already in the curriculum for primary and middle schools.[2] Here foreign language courses will start from the third year of primary school and middle school graduates are expected to have a fairly good foundation in one foreign language. The concept of key units is also found in foreign language training as the courses will first be taught in selected schools because there are not enough foreign language teachers.

Electronics

The electronics industry has been selected as a special case to exemplify the weight which is now given to research and the support of the advanced technology sectors of the economy. A national electronics industry conference met in Peking toward the end of 1977.[3] The day after the meeting ended, the People's Daily in an editorial discussed the future of the sector. Here it was categorically stated that "all branches of the national economy must be equipped with the technology of electronics before they can advance at high speed." Referring to the four modernizations the readers were told that "the electronics industry, as an important material and technological basis for the four modernizations, should be the first to be modernized." This would then require the modernization of the science and technology required for developing components, equipment and the manufacturing processes.

In connection with the 1977 electronics conference it has been emphasized that "compared with the advanced world levels, China's electronics techniques are more or less backward. We must admit such backwardness. To admit is to begin to eliminate the state of backwardness, and to catch up with and surpass the advanced." [4] There can be no doubt that there is strong eagerness in China to catch up. Why is it that electronics has become so important not only to China but to all countries that already are advanced or want to achieve modernization? The importance of sector is presented in the following way in an article on the electronics revolution published in a Science special issue of *Science* devoted to electronics. Here the authors say:

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[98] NCNA, Oct. 3, 1977, BBC FE/5634/B11/6.

[99] Peking Home Service, Sept. 29, 1977, BBC FE/5634/B11/6.

[1] Institutions of higher learning must do well in scientific research by the CCP Committee of the Chiaotung University, Sian, *Red Flag*, 1977, No. 8. Selections from People's Republic of China, CMP-SPRCM-77-29.

[2] New curriculum for primary and middle schools (NCNA, Feb. 27, 1978), BBC FE/5753/B11/2.

[3] People's Daily editorial on the electronics industry: "The level of the electronics industry is a hallmark of modernization" (Dec. 5, 1977), FE/5688/B11/2.

> The industrial revolution, dependent on energy and materials, will be slowed and limited by the paucity of these necessary ingredients. The electronics revolution, fueled by intellectual achievements, is destined for long-continued growth as its knowledge base inevitably increases. Obviously, the current rapid rate of evolution of electronics cannot persist indefinitely, but significant change is likely to continue for a long time.[5]

The electronics conference in Peking was a huge meeting with about 2,500 delegates from major enterprises, scientific research units, schools of higher learning representing all provinces, municipalities and autonomous regions of the country. Departments in charge of the industry were of course there. The electronics industry has already developed into quite a formidable sector with about 2,800 enterprises, of all sizes, spread over the country. Fifty-one research institutes more or less serving the electronics industry are attached to the fourth ministry of machine-building which is the central administrative unit in charge of the sector.[6] The development of the electronics industry is not evenly spread over the country and the sector is concentrated around some of the major cities and in the industrially advanced areas of the country. Kiangsu province including Nanking and encircling Shanghai, has for example 340 plants and workshops with more than 100,000 staff and workers engaged in producing electronic products. We may then conclude, assuming that the enterprises in Kiangsu are considerably larger than the national average that the electronics industry employs roughly 400,000 workers and staff.

Shanghai is seen as an important industrial base which "belongs to the people throughout China." The utilization and development of Shanghai's industry in support of the industrial development in other parts of the country with manpower, material resources and technology is discussed in a recent *Red Flag* article.[7] It is declared that the city should produce more high-quality products which are urgently needed by the state and which are technically difficult to produce. This can be done because Shanghai has the well-trained scientists and technologists, a number of scientific institutes which are materially and technically well-equipped, and long experience in organizing large joint projects and tackling major problems.

Certain basic industries are singled out where the development forces of Shanghai should be concentrated and electronics is one. In addition, the iron and steel and petrochemical industries are singled out. Here, the development and technology surrounding the major component—the electronic computer—is said to require special attention. And the electronic computer technology should be applied extensively in all industrial, communications, capital construction and scientific research. In further strengthening the foundation of electronics industry, the mass production of integrated circuits and computer software have to be properly developed. If this is done, Shanghai can envisage a breakthrough in quantity and tremendous leap forward not only in electronics but also in other industrial sectors as regards variety, quality and production technology with considerable benefits for the whole country. In this discussion the target is set on 1985 which is the end of the sixth 5-year plan. What is the situation like today?

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[4] People's Daily editorial calls for rapid development of electronics industry. Hsinhua Weekly issue (London), No. 460, Dec. 8, 1977.

[5] Philip H. Abelson and Allen L. Hammond, "The Electronics Revolution." Science, vol. 195, No. 4283 (Mar. 18, 1977).

[6] People's Daily editorial on the electronics industy: The level of the electronics industry is a hallmark of modernization (Dec. 5, 1977). FE/5688/B11/2.

[7] *Red Flag* article by Peng Chung on development of Shanghai industry, BBS Summary of World Broadcasts, FE/5691/B11/1.

It is already widely known that China's electronic industry makes equipment for the launching and recovery of its own earth satellites which includes tracking, logging, and controlling systems. The sector also designs and turns out telecommunications, radar, broadcasting and television equipment, logging and surveying meters and navigational computers. All the semiconductor parts, integrated circuits and electronic elements necessary for the manufacture of such equipment can be made in China. China also turns out fairly up-to-date telecommunications equipment. Even if China has reached a high level of manufacturing capability there is still 10 percent of the telecommunications equipment installed in China which has to be imported.[8]

Wang Cheng, Minister of the Fourth Ministry of Machine-Building, responsible for the electronics industry in a recent interview made the following comments.[9]

> . . . within the realm of the national economy, our electronics industry is a relatively weak link, the technical level of its products is not high, its production efficiency is low, and it still cannot meet the needs of national defense and the building of the national economy. There is still a considerable gap between the level of our electronic technology and advanced world levels. We are not behind in the development of semi-conductors, computers and other specialized fields, but the gap between us and advanced world levels in other areas has widened. . . .

Another problem is that production, in some areas, has not been able to meet the demand with the consequence that "some units have their representatives waiting for their orders for long periods of time . . ." More serious may be the poor quality of some electronics products. There is no doubt that a low ratio of up-to-standard electronic products results in a waste of raw and semifinished materials and slows down the speed of development of the electronics industry. In particular, the ratio of up-to-standard integrated circuits, high-frequency, and high-voltage products has been reported to be low. As an example of the poor reliability and the need for repairs it is mentioned that the television sets awaiting repair account for 8 percent of the sets in the country. Often the maintenance and repair centers set up by the commercial departments cannot cope with the situation. Consequently, factories also have to carry out repairs thereby slowing production.

In order to solve such problems and allow electronics to make its full contribution to China's modernization the Fourth Ministry of Machine-building is mapping out a long-term program for the development of electronic technology. Wang Cheng, the minister, says that:[10]

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[8] NCNA on achievements in telecommunications, BBC FE/W951/B/1.

[9] Minister interviewed on electronics industry prospects (NCNA, Nov. 16, 1977), BBC FE/5683/B11/10.

[10] Minister interviewed on electronics industry propsects (NCNA, Nov. 16, 1977), BBC FE/5683/B11/10.

> . . . our ideas are to grasp the vital scientific technology that is fundamental in nature and influential to the whole situation, including integrated circuit technology, solid electron technology, electronic computer technology, photoelectron technology and space electron technology, and regard them as the major points of development. . . .

He also says that the development of electronic technology depends on the development of basic scientific research. Therefore, there has to be a vigorous support of the state scientific research departments. In building a comprehensive electronic scientific research system the minister also stresses that scientific research must be allowed to proceed production and construction—an important theme of the science and technology debate which is discussed elsewhere. With reference to the international situation he also points to the need of correctly handling the relationship between study and self-creation and to study honestly and modestly all (foreign) advanced science and technology. Finally, he says that it is necessary to bring up a large number of scientists and technicians for the industry. Furthermore, in addition to the professional personnel needed in the electronics sector itself China will also need all kinds of professional personnel in related areas such as physics, chemistry, mathematics, and machine building. A consequence of this can be seen in the fact that electronics is also one of the subjects besides mathematics and English in which the Chinese television introduced educational courses toward the end of 1977.

The development of the electronics industry must be closely integrated with that of the machine-building industry. Here one of the problems lies in the consolidation of the enterprises to reduce the shortcomings in production referred to earlier. The practical problems, aside from the ideological ones, discussed earlier, concern such matters as innovations in equipment and technology, improvements in the working environment, and enterprise management. In a People's Daily editorial it was pointed out that in quite a few enterprises no attention is paid to enterprise management, the division of responsibility is unclear and no one is in charge of quality control. Some factories, the article says, have changed operational and technological procedures without authorization and caused extremely adverse effects on the quality of products. As a summing up the article concludes that "most the urgent task at present is to institute and improve the system of personal responsibility." This has its parallel in the reform of institute leadership discussed earlier.

What are the reasons for the emphasis now given to the development of electronics industry in China? The sector cannot be considered a basic industry in the same as energy, steel, and petrochemicals are. Nonetheless, electronics constitutes an integral component—and increasingly so—in establishing a modern industrial state.

The People's Daily editoral referred to earlier, says that all branches of the national economy must be equipped with the technology of electronics before they can advance at high speeds. Whether in the modernization of industry, agriculture, science, and technology or national defense advanced electronics techniques must be adopted to insure rapid growth, high quality, and high precision. More important—at least judging from the emphasis in the article—is labor productivity.

Marx' comment in discussing machines and big industry—"A well-organized system of working machines driven by a central automatic device through a transmission system is the most advanced form of production by machines"—is stressed, and seen as justification for developing the electronics industry. The "central automatic device for the well-organized system of working machines" is becoming reality in the form of control equipment with the electronic computer being the feature. In the same discussion we also learn that China's labor productivity is still low and the labor productivity of many departments had become even lower due to the "gang of four's" sabotage of enterprise management. This is not acceptable because as Lenin pointed out: "Communism means the creation of a labor productivity higher than under capitalism by the workers, using advanced techniques voluntarily, consciously, and jointly". In the final analysis, labor productivity is the more important and primary guarantee for the victory of the new social system the article says. And the fundamental way for rising labor productivity today is the application of the technology of electronics and other advanced sciences and technologies. However, the development of the electronics industry was seen in a very different light in the early 1970's when the sector was also under public debate. At the time the debate centered on the relative importance of steel and electronics and the outcome was that the steel was the more important.

The discussion in 1971–72 on the relative importance of the steel industry as opposed to electronic technology[11] has sometimes been interpreted as a discussion between the military and civilian sectors, with the military advocating more electronics, for advanced weaponry. This is likely to be part of the explanation, but should not obscure other considerations which may be more basic to the whole development strategy of China. The electronics versus steel "controversy" can be seen as a political theme which was used to influence planners at different levels about the priorities for further development.

Heavy emphasis on the development of electronic technology was, at the time, seen as detrimental to the development of more balanced socio-economic relations between cities and countryside. Electronic technology introduced before extensive skill formation has taken place all over the countryside—would be likely to increase greatly the difference in productivity between modern industry and rural industry, since electronic technology would be used mainly in urban-based, and relatively large plants. In addition to this, emphasis on electronic technology would be likely to reduce the availability of those planning resources needed for the transfer of technology to rural areas and the development of a local steel industry.

Today, the use of electronics to increase labor productivity and for national integration is seen as a much more important objective. The sector no doubt plays an important role in telecommunications which is an area undergoing rapid modernization. A nationwide telecommunications network is under construction making use of microwave radio beams and the latest developments in telecommunications. At the conference on Posts and Telecommunications held in July 1977 the telecommunications needs of the rural areas were strongly emphasized. The modernization of posts and telecommunications will be basically completed in the country's 2,000 counties by the year 1980. Circuit carrier telecommunications equipment and microwave telecommunications trunk lines will form a network. By the year 1985, postal and telecommunications departments will be using electronically, automatic and mechanized equipment. Today it is only Peking, Shanghai, Tientsim, Nanking, and four other major cities which have adopted the automatic dialing system and still only for part of their long-distance telephone calls.

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[11] See for example "People's Daily on Relative Importance of Electronic Industry," Peking Radio, Aug. 12, 1971, SWB, FE/3766; Kuang-ming jih-pao. Dec. 13, 1971, "Line Struggle in Industry—A Criticism of Liu Shao-chi's and Other Political Swindlers Theory of 'Electronics as the Core'." SCMP, No. 5045, Jan. 3, 1972

The future role of telecommunications and its application to research becomes obvious in a visionary statement in Chien Hsueh-sen's article on science technology in the Red Flag last summer (July 1977).[12] After saying that the policy on intellectuals in order to make fullest possible use of the professional contingent in the field of science and technology requires particular attention he goes on discussing several professional projects and one of them is to organize the country's vast number of scientific and data units into a nationwide information and data network. Chien visualizes this to be achieved through high-density signal storing and computer indexing and by using communications circuits, terminal videoscreens and other such equipment. This would then enable scientific research personnel in any place to check or read the nation's scientific and technical documents and promptly obtain the information and data needed from the network.

The Chinese views or rather Chien Hsueh-sen's personal views, on this subject are very similar to comments made in the Soviet Union in recent years and which are exemplified by the following quotation:

> It is also important to organize an efficient computerized information system, which is a sine qua non of rational planning in science and greater efficiency of the creative scientific effort, for it helps scientists gain a knowledge of the state of Soviet and world science, of the latest scientific discoveries and technical developments, the tendencies of scientific and technical progress, and so on. It is a necessary prerequisite of the system of planning and prognostication in science and technology.
>
> Automated data-search systems are operating all over the country and new ones are being established. The long-term target is to create an automated data system for the whole country.[13]

The system envisaged is partly similar to the computer-based retrieval systems which today are linking a large number of research laboratories in Western Europe, the United States, and Japan. Few of the data bases have fulfilled the early expectations and researchers working in the frontline are often better served by a personal network of contacts for the exchange of information.

Concluding Remarks

At the National People's Conference the Premier Hua Kuo-feng in one of his speeches put particular emphasis on developing science.[14] He said that modern science and technology are going through a "great revolution" which will lead to the emergence of new industries and speed up technological development. That world level, great power science is very much in the minds of the Chinese planners is evident when he says that "modern science and technology are characterized mainly by the use of atomic energy and the development of electronic computers and space science". But, he also says that China will give full attention to theoretical research in natural science including such subjects as mathematics, high energy physics, and molecular biology and that there will also be a national research plan for philosophy and the social sciences. The changing views on science and technology is reflected in the new constitution which has a special article on the subject.

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[12] Chien Hsueh-sen's *Red Flag* article on science and technology, BBC FE/5563/B11/6.

[13] Socialism and the scientific and technical revolution (25th Congress of the Communist Party of the Soviet Union), Progress Publishers, Moscow, 1977.

[14] Premier Hua stresses importance of developing science [Peking, Mar. 7, 1978], Hsinhua [Stockholm], 1978, No. 59.

> The State devotes major efforts to developing science, expands scientific research, promotes technical innovation and technical revolution and adopts advanced techniques wherever possible in all departments of the national economy. In scientific and technological work we must follow the practice of combining professional contingents with the masses, and combining learning from others with our own creative efforts.[15]

The objectives of narrowing the technology gaps and increasing labor productivity are themes that transcend the reawakened attention now given to the development of technology and science. The focus is on the needs for new technology in the modern sector where national integrated systems and large scale manufacturing becomes logical and unavoidable choices. The policy choices already taken along this road are likely to have two important consequences. First, the highly trained professionals—elite groups or intellectuals—are coming back in their own right, associated with requirements for centralization and hierarchical structures. There is also an urgent need to increase their numbers—that is to enlarge the capacity for reproducing the professionals within the Chinese society by expanding university and postgraduate training. Second, the technology for the required large-scale, complex systems can, in the short run, only marginally be created within the country. Foreign technology consequently becomes more important and Shannon Brown for example argues that:

> Because importation is the most efficient method of acquisition, nearly all new technology introduced in China in the near future will originate abroad and will be brought into the country by . . . the importation of printed matter, machinery and equipment, and complete plants, and the transfer of knowledge through the movement of people. Very little technology is likely to be developed de novo, although considerable adaptation of imported technology to Chinese conditions will be necessary.[16]

Naturally, this means a different interpretation of self-reliance and Brown argues that self-reliance will increasingly mean the "mobilization of Chinese efforts to select, adapt, disseminate, and use within China the highly productive new technology already developed elsewhere. China's efficiency and effectiveness in performing this task will do much to determine her rate of economic development."

If we accept recent Chinese statements on the country's level of technological development, and I see no reason for discounting them, a picture emerges which shows increasing technology gaps in a number of industrial sectors. The machine-building minister responsible for electronics has said that the gap in many areas of electronics has been widening.[17] The minister of the coal industry expresses a similar concern and says:

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[15] Article 12 of the Constitution of the People's Republic of China, adopted on Mar. 5, 1978, by the Fifth National People's Congress of the People's Republic of China at its first session, BBC FE/5759/C/1.

[16] Brown, Shannon R., "Foreign Technology and Economic Growth," *Problems of Communism*, vol. 26, No. 4 (July–August 1977).

> That in the early 1960's the gap in mechanization between China's leading coal mines and the world's major coal-producing countries was not too large. However, it was widened later on. China is behind advanced world levels in labor productivity and other economic and technical indicators.[18]

The same concern about technology gaps is also evident in an interview with Chien San-chiang, deputy general secretary of the Academia Sinica. He stated to Tanjug News Agency "that compared to the level of science in the world today, China is between 10 and 20 years behind, varying from field to field. This gap was smaller in 1965, but it increased during the Cultural Revolution * * *." [19]

Given the present maldistribution of the global capacity for research and development a Chinese policy to stress the importation of technology of various kinds is apparently a logical choice. The Chinese R. & D. budget is estimated to be roughly 4.6 billion yuan which is only three times the Swedish allocations for the same purposes—in a country with one hundredth of the Chinese population. Seen in a global perspective the Chinese allocations of R. & D. resources is of the order of a couple of percent of the world's total spending.

Two important consequences follow from an assumed policy toward increasing use of foreign technology. First, the selection of foreign technology requires increased information about products and processes and such data must be screened, systematized and made available to large numbers who independently can evaluate and criticize what is potentially available. The need to closely follow developments abroad is also evident in scientific research on which Chou Pei-yuan said that the various disciplines are being knit ever more tightly together with leading fields and new branches of science rapidly developing. With this in view and the achievements abroad he underlined that vigorous academic exchange must be seen as an integral part of scientific research. So, he stressed that "research in every project must keep pace with latest developments, both domestic and international".[20]

Second, the importation of foreign technology requires foreign exchange, which in the absence of long term credits or development assistance both being ruled out, requires a commensurate development of the export sector. At present Chinese exports mainly consist of agricultural produce, and minerals. The industrial goods exported are mainly competitive because of price rather than performance. Boosting the export sector would, aside from the policy decision to allocate investment resources, also require new, partly imported technology in order to reduce costs and improve product quality. Otherwise, China would use low-cost labor with low productivity in order to pay for the imported technology used elsewhere in the economy—a situation which might be accepted for a certain period of time. Thus, a dilemma is facing the Chinese planners. In order to pay for imported technology it may be necessary to import still more technology.

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[17] Minister interviewed on electronics industry prospects, NCNA, Nov. 16, 1977, BBC FE/5683/B11/10.

[18] Chinese minister of coal industry on mechanization, Hsinhua News [Stockholm], 1978, No. 16 [Peking, Jan, 18, 1978].

[19] Tanjug in English, Jan. 26, 1978 [BBC FE/5730/B11/12—the quotation marks refer to the text printed in the BBC summary of World Broadcasts].

[20] Chou Pei-yuan calls for vigorous academic exchange (People's Daily, Feb. 6, 1978), Hsinhua News (Stockholm), 1978, No. 38.

Many developing countries accept joint ventures in order to get access to efficient foreign technologies. Other countries who want to have a better control of their development reject this but often accept various other schemes. The recent views on the subject in the U.S.S.R. can be seen from the following quotation.[21]

> Product-payback schemes have also gained wide currency. Under these schemes, the socialist countries attract foreign credits for the construction of enterprises and eventually supply their creditors with a share of the products these turn out. Such credits are usually channeled into areas where the STR (scientific and technical revolution) is in full swing.

However, there is no indication that the Chinese leadership would, at least for the time being accept, even in high technology areas, such collaboration which might be beneficial in a narrow technical sense.

There are in various Chinese statements a number of vague references to the technical revolution when discussing China's future in science and technology. The internationally well-known scientist Chien Hsueh-sen recently said that "modern science and technology is on the verge of major breakthroughs" and he sees electronic computers as one of the very important areas when he says that "we are faced with new technical revolutions".[22] These quotations are from an interview with Hsinhua News Agency and he says later on, with reference to Mao, that the use of electricity in bringing about a concentration of industry and agriculture at the end of the last century was a technical revolution. Further, he sees atomic energy as constituting another technical revolution. He then poses two questions. "Is electronic computer technology a technical revolution? Should we actively promote this technical revolution?" He doesn't answer the questions but according to the Hsinhua correspondent "his view seemed to be very much in the affirmative". It might benefit the readers to have a few references to Soviet policy statements on the scientific and technical revolution.

In the U.S.S.R. a new [second] revolution in technology is seen as paving the way for a transition from mechanization to automation—with a closer integration with science. This is one of the elements in the Soviet view of the scientific and technical revolution. Automation appears to be instrumental to the development of an advanced chemical industry, the use of microtechnology, and the development of atomic energy. There may be many similarities but also a number of distinct and important differences with this view and the views on science and technology emerging in China over the past couple of years.

The reasons for this are manifold. First, the Soviet Union is a planned economy which has a number of superficial similarities with China. Second, the U.S.S.R. stresses the significance of the scientific and technical revolutions in terms which are occasionally identical or similar to recent statements in China. Third, some foreign observers have pointed out that the People's Republic of China will approach the roads to technological modernization already taken by industrialized countries like the U.S.S.R. Consequently, the choice has been made to emphasize some of the similarities in the views on what and how science and technology is going to accomplish in the two countries. It is the author's hope that by pointing to similarities it is also possible to underline the distinct differences which exist between the two countries.

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[21] Socialism and the scientific and technical revolution [25th Congress of the Communist Party of the Soviet Union], Progress Publishers, Moscow, 1977, p. 99.

[22] Chien Hsueh-sen on modern science and technology [Peking, Feb. 10, 1978], Hsinhua [Stockholm], 1978, No. 36.

In an article on the scientific and technical revolution in the U.S.S.R. the well-known Soviet analyst, Julian Cooper, concludes that:

> Soviet theorists see no necessary incompatibility between the use of technique developed under capitalism and the struggle to create a socialist society. That new technical means frequently involve organizational and other social changes not denied; what is denied is that the content and social meaning of these changes are uniquely determined by the fact that the innovations derive from a different social system.[23]

The concept of a scientific and technical revolution has been used in the U.S.S.R. since the mid-1950's and in the party programme it was first referred to in the program of 1961. The concept has been analyzed and discussed in great detail by a number of Soviet writers. Some of their views are conflicting and the reader should refer to the full article to get a better understanding of the debate. One of the groups makes a clear distinction between the technical revolution and the production revolution where the latter is growing out of the former following a successful social revolution on which Cooper makes the following clarification:

> The production revolution marks the transition to a new technological mode of production, five of which are identified: simple craft production associated with agriculture, simple craft production separate from agriculture, manufacture, machine-factory production, and comprehensively automated production characteristic of communist society.

Others differ on this and maintain that this approach is shortsighted because mechanical technology is near the limits of its potentialities and automation of such technology cannot give rise to any significant improvement in its productivity and maintains that—

> The possibilities of mechanical implements of labor are nearing exhaustion, and as a result the process of transition to the application of various types of nonmechanical technology has begun. These nonmechanical forms of movement of matter (at molecular, atomic, and subatomic levels) can only be used technologically if control functions are transferred to technical means. This combination of nonmechanical technology with the principles of automatic control will permit the achievement of a fundamental change in the productivity of technique.

An elaboration of this point is that the scientific and technical revolution can be better understood as a revolution in the control of the natural processes involved in manufacturing processes or even as revolution in the control of processes. This is a viewpoint which comes closer to the Chinese emphasis on petrochemical industry, computer technology, and space projects.

An important element of the Soviet theory of the scientific and technical revolution is the process of the transformation of science into a direct productive force. Cooper points out that there exists in the U.S.S.R. two opposing views. The first sees science as an ideal force of knowledge so that it "should be regarded as a direct productive force on its own account without the mediation of technique." The other view is that science can only become a productive force through technology or people engaged in production. Consequently, it cannot be seen as an independent element but only as knowledge materialized in the material productive forces. In summing up the scanty references made to a major article I will again quote Cooper:

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[23] Cooper, Julian M., "The Scientific and Technical Revolution in Soviet Theory in Technology and Communist Culture," Fleron, Frederic J. Praeger, [ed.], New York, 1977.

> . . . all agree that science is to an ever-greater extent being transformed into a direct productive force and that the STR gives rise to profound social consequences, above all connected with the changing place of the worker in the production process. Finally, all contributors accept that the outcome of the STR depends on the nature of the social relations of the society in which it is taking place.[24]

A similar point is stated by Yuan Pao-hua, Vice Minister of the State Planning Commission. At the National Conference For Exchanging Experience on Technical Innovations in Industry and Communications held at Yentai, Shantung, January 15–22, 1978, he said when discussing "conservative ideas" about new technology "that ideological hindrances of all forms should be removed." The exact meaning of an expression like this is still to be clarified and may not necessarily have any deeper significance. But, those who have in the past been mainly concerned with ideological or political matters with little contact with modern science and technology may have to engage in some studies in order to understand the role of science and technology. The same Minister, Yuan Pao-hua, indicated that implementing the technology and science programs requires the training of those directly or indirectly concerned:[25]

> We must launch a movement to learn modern science and technology in the whole Party and among the people throughout the country. In the next few years all technical personnel, cadres and workers should receive a period of training and technical study should be made a regular practice. Cadres in leading positions should set the pace in this and take personal responsibility for popularizing new techniques.

What are the political implications if any, of the changes in technology policy. Here I would like to refer to Dernberger who says that:

> The radicals, . . . using the Soviet experiences as an example, realize that the moderates' economic policies may well involve the creation and entrenchment in Chines society of social values and behaviour that are antagonistic to the objectives of achieving a true socialist society so much so that this objective is not only postponed but eventually eliminated.

This Chinese version of the science and technology revolution has its expression in their education policies. Many foreign observers have voiced the concern that the system of examination and selection for colleges and universities will create an elite in China. In an interview with "a leading member of the Ministry of Education," distributed by NCNA, this notion is refuted.[26] It is admitted that, for the time being, only a limited number of students can get the opportunity to go on to university studies. But in making the selection it is seen natural to use examinations and priority is given to worker-peasant candidates, or candidates from similar family backgrounds when their qualifications are more or less similar. Certain specialized institutions like agricultural, medical, and teachers' colleges "pay attention to admitting agrotechnical enthusiasts, barefoot doctors, and local school teachers." In addition, some colleges undertake the training of people for rural communes with students going back to their communes after graduation.

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[24] Cooper, Julian M., "The Scientific and Technical Revolution in Soviet Theory in Technology and Communist Culture." Fleron, Frederic J. Praeger, [ed.], New York. 1977.

[25] Vice Minister of Planning Commission on Adoption of Advanced Technology, Hsin ua News [Stockholm], 1978, No. 25 [Tsinan, Jan. 29, 1978].

[26] "The Educational Reforms and Prevention of Elitism," NCNA, Feb. 11, 1978, BBC FE/5739/B11/2.

Another important fact is that wages are low for the "millions of qualified college students" who have been trained after 1949. Their wages are almost the same or only slightly higher than their worker counterparts, with at present less than 100 yuan for the earliest graduates of the period and around 40 yuan for the more recent graduates. The average wages for industrial workers is in the region of 60 yuan with a span of 3 to 1.

The questions of elitism and the possibility that elite groups in the Chinese society develop into privileged classes is naturally related to the questions of urban-rural relations, income inequality, professionalism, and the rates of development in industry and agriculture and the terms of trade between these two major sectors of the economy. However, most important may be the questions related to the rapid development of the quaternary sector and the attitudes of those who make up that sector.[27] Within that sector is found the bulk of the decisionmaking activity, administrative services, and research. This fourth sector can be seen in parallel to the other three major sectors—raw materials production, manufacturing, and services. The sector plays an important role in all advanced economies because success in most economic fields is dependent on administrative expertise particularly in the development of industrial goods. Even the production of public goods and services increasingly requires specialist administrative guidance and coordination.

A related question is the need to standardize industrial products and mass produce them. Farm machinery is manufactured in a large number of plants and the call to stop the disorderly production of some farm machinery no doubt is likely to mean that part of the rural industrial structure will be reorganized. This relates particularly to the engineering sector of local industries and it is now declared that "The problem where parts for farm machines of identical numbers are not interchangeable must be solved." [28] This is of course a clear indication the sector will receive much more attention from the central authorities and coordination measures will be implemented in order to organize the farm machinery for mass production. The resulting changes will, it is hoped, make it possible to raise the quality of products, cut production costs, and make operation and maintenance easy in the countryside.

The tasks carried out within the quarternary sector can be categorized as higher level administration and would include formulation of ideas, exchange of ideas, exchange and processing of information, planning, management, and coordination. It can be seen that those engaged in such activities make up a large proportion of the group intellectuals. Many of them may only vaguely relate to workers and peasants except, through family background. With an increasing emphasis on professionalism and specialization and a subsequent reduction in requirements for manual labor many of those who make up the quarternary sector may tend to look upon themselves as superior. Compounding the problem is the fact that specialization leads to centralization much of the information needed for decision-making can readily be transferred using modern telecommunications. However, the qualitatively important parts will still require individuals to travel and meet, the consequence of which is that very high levels of interaction is found in a few dominant places within a country. This clearly points to centralization which is a consequence of the need for key individuals to minimize the time needed for travel and external contacts.

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[27] I am indebted to Tommy Carlstein for sharing a preprint copy of "The Study of Activities in the Quaternary Sector," by Lars-Olof Olander and Tommy Carlstein, to appear in Carlstein, Tommy, Parkes, Don and Thrift, Nigel, eds., "Human Activity and Time Geography," Timiny Space and Spacing Time, vol. 2, Edward Arnold Publishers, Ltd., London.

[28] National Conference on Agricultural Mechanization, NCNA, Jan. 4, 1978, BBC FE/5707/B11/7.

The development of the industrial enterprises in rural areas—in particular the collectively owned ones which have proliferated within communes and brigades in recent years pose a number of problems with regard to equality. The wages paid to the workers in such industries are with few exceptions higher than what the agricultural laborers receive in the area surrounding the industrial units. In a news item publicizing the experience of a brigade in Kwangtung it was stressed that "payment from brigade-run enterprises for each person transferred from a production team should be given to the individual's production team".[29] It is then being incorporated with the team's work points to be distributed among all the commune members, including those who work in the brigade-run industries. Whether this policy will be upheld nationwide or not will not be discussed here. However, there is a compelling logic in view of the low level of mechanization and the rapid development of brigade and commune-run industries. The most important asset of the production team is its labor force and the indicated policy assures that the renumeration to the team. If activity is outside the production team benefits are to the members of the team and not to the separate individuals.

However, there is also another problem with regard to the small-scale industries in rural areas. The labor productivity is much lower in the collectively owned enterprises than in the State-owned rural industries which in turn is considerably lower than in the large-scale State-owned enterprises, mainly located in the urban areas. In terms of average productivity the ratio is 4 to 1 in favor the large State-owned enterprises, according to estimates made by the author. The lower labor productivity is a reflection of quality of management, amount of capital and the technology utilized. As capital and technological resources are allocated on a priority basis to the large State-owned enterprises the inevitable consequences will be that the relative productivity of the smaller, rural, enterprises will remain low. This may not be an explicit objective in the present policy of strengthening of management and central initiative. However, in discussing technical innovations at a national conference Yuan Pao-hua, vice-minister of the State Planning Commission, had the following to say: [30]

> In the system of industrial management, there must be planned reform to effect specilized production. It is not right for us to build large or small factories that engage in all kinds of specialties. New technologies are recommended only for large-scale, specialized mass production.

Similar views, which might be detrimental to the local industrial development were also voiced when discussing policies for the mechanization of agriculture in the beginning of 1978, already referred to earlier.

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[29] "Production Team as Basic Unit in Three-Level Ownership," NCNA, Feb. 13, 1978, BBC FE/5743/B11/12.

[30] Vice Minister Yuan's speech at Technical Innovations Conference, NCNA, Feb. 3, 1978, BBC FE/5739/B11/9.

Finally, of special note are some issues which have been hotly debated during the past couple of years, on the role of basic, theoretical, and long-term research. As long as China had an untapped potential for applied knowledge and resources for economic development the priority to basic, long-term research may not have been an important question. But foreign observers and the Chinese themselves clearly see that this is no longer the case and the gap between basic research in China and advanced countries may be widening rapidly in a number of sectors. Long-term basic scientific research basically requires additional resources. But this matter of priority there has been a clash with the proponents of alternative views propagated by "the gang of four". The proponents were arguing that the research institutes should carry out open-door research in order to meet immediate needs in the production without revised priorities.

The radicals views on research is, of course, related to their attitudes toward researchers and other intellectuals. In the opinion of "the gang of four" the researchers must not be treated differently from ordinary people. Laymen and researchers should be equal. On that ground it was unacceptable that researchers could withdraw from the demands for manual labor, political work, et cetera, that other groups in the Chinese society were requested to fulfill. It has now been clearly pointed out such a situation hindered the research and technological development that China needed for the future. As a result of the acceptance of this view the students trained at the universities during and since the Cultural Revolution were insufficient in numbers and quality.

The more fundamental differences between "the gang of four" and the new Chinese leadership relate to egalitarianism and professionalism. The Cultural Revolution emphasized strong egalitarian forces in the Chinese Communist society. These were of broad appeal to the young people who in China, like many other developing countries, constitute 45 percent of the age groups under 20 years. However, the demand for a more equal and just society were only partially articulated into programs which had any chance of implementation. The juster Maoist society of which many had a vision should not accept any priviliged groups. This criticism turned against the established institutions like universities and research institutes, aside from the bureaucracy and the class struggle, was one of the instruments to achieve changes. But the class struggle as a political instrument also led to an antagonistic view of the intellectuals. They were seen more or less as potential and permanent enemies and therefore the class struggle within universities and research institutes had to be institutionalized, according to the view of "the gang of four". The resulting political struggle, in the institutes, and the general demands for open door research, no doubt, contributed to lowered efficiency and quality.

The new party leadership has now resolved the issues and clearly stated that the radical views were mistaken and would hinder the socialist transformation of the Chinese society because it obstructed the development of the material base. The present view is that science and technology is a productive force—that is to say an instrument. Consequently, science and technology—and the scientists and engineers as well—should not be seen as part of the superstructure and no longer constitutes a conflict with the economic base. Thus, the scientists and engineers should not be opposed but supported. Another important consequence is that the organizational problems should be solved differently. If science and technology is a productive force, that is, an instrument of the State, the sector should be organized as efficiently as possible to make as early and significant a contribution as possible to the planned socialist transformation. Therefore, the scientists in the research institutes who were previously considered as politically unreliable need no longer be controlled within the groups to which they belong. The external political control on how resources are utilized does not, of course, disappear. But, the professional resources within science and technology are seen as a key instruments toward achieving long-term goals in China.

When we try to assess the changes in China it may always be useful to maintain a historical perspective as all changes may not be permanent and we can expect that China will experience political struggles between opposing views on the role of science and technology and how the sector should be controlled and organized. Is there any risk that China will eventually move toward political changes such as have taken place in the Soviet Union and which the Chinese term revisionism? No doubt, the heavy emphasis on economic growth and the use of the intellectual and technological expertise in the country may make it difficult to strike a stable balance.

The new technology and science policy now emerging in China may be an element which is at least partly antagonistic to the objective of reaching the socialist society conceived by Mao and the reasons for this are several: First, to meet the technology requirements of the modern industry the emphasis must be on large systems with a high degree of vertical division of labor with apparent nonegalitarian consequences for management in production enterprises as well as in the related R. & D. institutions. Second, trend toward further professionalism and inequality encouraged importation of technology where technological and management solutions developed in capitalist countries must be adjusted to suit Chinese conditions. If this were desired, the integration and coordination of large scale technological projects and the subsequent applications in manufacturing will require professional expertise which must be highly trained and competent. All such people will spend much of their time in central agencies, ministries or offices in the bigger cities with little or at least less time than previously to move into manual labor. Fourth, a large scale approach to industrialization also requires improved transportation and communications and new management systems which all lend some credibility to the argument that new forms of social control might develop which are detrimental to the egalitarian interests of the masses of the Chinese population.

In all fairness, it must be pointed out that the policy statements, so far available to us, clearly indicate that the leadership is bent on maintaining a balance of technological development between the various sectors of the society, this implies the continuation of a two-leg policy. However, in carrying out such a policy it is always noted, indeed underlined, that the professionals are to form the backbone in any new undertakings where the masses are involved. This may gradually lead to a situation where indigenous technological development is downplayed thereby favoring an increased emphasis on the importation of technology. More ambiguous effects could be found in a situation where the present momentum to reinstate the professionals, technicians, engineers, researchers, and other intellectuals cannot be stopped.

The result might then be that these people establish themselves as new privileged class with the blessing of the party and military bureaucracy. Such a possibility cannot be ruled out because, for example, if the food supply problem is resolved, there is no urgent need, in the short run, to divert large R. & D. and investment resources into agriculture as this would only aggravate the issue of unemployment and labor allocation. For the time being in China, as in many other developing countries has no other choice than to use agriculture as a residual employer. Consequently, development resources such as engineering manpower, R. & D. resources, et cetera, are likely to mainly flow into the modern industrial sector. This might then add additional support to the hypothetical possibility that certain key groups in the urban-based modern economy establish themselves as privileged groups to the detriment of the majority of the population residing in rural areas thereby changing the broad economywide emphasis or scientific and technological change.

So, it might be appropriate to pose the following question. The emphasis is on urban technological change—will it be possible for the Chinese leadership to maintain a fair balance between urban industry and rural agriculture? Herein we can find three different type problems with regard to changes in technology and science policy. First, will the leadership be able to maintain the delicate but necessary balance in meeting the modernization objectives while reflecting the legitimate interests of the various groups in the Chinese society? Second, as the potentially privileged groups will make use of the new situation to further their own interests, in ways detrimental to the majority of the population in the rural areas will this nonprivileged majority create a counterforce in order to redress the balance? Should this be the case the present change in technology policy would create an unstable situation. Third, will the changes create a situation where privileged groups become established as a stable new class to the detriment of the overall, long-term development of China?

It must also be emphasized that the current situation in China is rapidly changing and the structure for encouraging innovations and change in technology and science policy has not been fully worked out. The current debate on science and technology, as reflected in the news media over the past couple of years, can thus only shed limited light on the future development of science and technology in China.

CHINESE EMPLOYMENT POLICY IN 1949–78 WITH SPECIAL EMPHASIS ON WOMEN IN RURAL PRODUCTION

By Marina Thorborg

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List of Abbreviations

ACDWF—All-China Democratic Women's Federation
ACWF—All-China Women's Federation
APC—Agricultural Producers Cooperative
CB—Current Background
CCD—Communist China Digest
CCP—Chinese Communist Party
CFJP—Chieh-fang jih-pao (Liberation Daily)
CKFN—Chung-kuo fu-nü (Women of China)
FBIS—Foreign Broadcast Information Service
HCKFN—Hsin chung-kuo fu-nü (Women of New China)

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HHPYK—Hsin hua pan yüeh-k'an (New China Semimonthly)
HHYP—Hsin hua yüeh pao (New China Monthly)
HK—Hong Kong
JMJP—Jen-min jih-pao (Peogle's Daily)
KJJP—Kung-jen jih-pao (Workers' Daily)
KMJP—Kuang-ming jih-pao (Enlightment Daily)
NCNA—New China News Agency
PRS—Provincial Radio Station
RPC—Rural People's Communes
RS—Radio Station
SCMM—Selections From China Mainland Magazines
SCMM Supplement—Selections From China Mainland Magazines Supplement
TKP—Ta Kung Pao (The Impartial)
URS—Union Research Service
WHP—Wen hui pao (Wen hui Daily)
YCL—Young Communist League

INTRODUCTION

Several years of national recovery followed the victory of the Chinese Communists in 1949 and the end of civil war in the following year. Known as the rehabilitation period, it officially ended in 1952. The first 5-year plan (FFYP) period began in 1953 and ended in 1957. The following quotation from Chairman Mao Tse-tung's address on "Coalition Government," May 1945, summarizes the long-range goal of employment policy during these years:

> It is the peasants who are the source of China's industrial workers. In the future additional tens of millions of peasants will go to the cities and enter factories. If China is going to build up powerful national industries and many large modern cities, there will have to be a long process of transformation of rural into urban inhabitants.[1]

Transfer of labor from agriculture to industry was seen as a necessary precondition for economic development. The immediate short-term aim was recovery from more than a decade of war and achievement of increased production and an adequate living for the people of China. Greater labor inputs in combination with such institutional changes as land reform and the successive stages of cooperativization of agriculture were considered to be the best means of increasing agricultural production.[2] In addition the policy of the Communist Party was to increase the area of cultivation, double cropping, and irrigation. At this stage mechanization of agriculture was not conceived of as a viable alternative for the immediate future.

POLICY ON RURAL EMPLOYMENT

Policies toward women in China are one aspect of the overall attempt to transform the whole country. Every change in general policy has engendered a concomitant change in policy on women. After 1949 the policies that were developed for employment in urban and rural areas showed marked differences.[3] The differences were most clear out in policy statements on employment of traditionally marginal groups in the labor force, such as the young, the old, and women. In contrast to employment of women in urban areas, at no time were women in rural areas officially encouraged to refrain from taking part in production. In rural areas, as policy on the employment of women developed in the early 1950's, women were urged to take part in agricultural production, and increase the number of days they did farm work.

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[1] Mao Tse-tung, "Selected Works of Mao Tse-tung." vol. III, p. 250. Foreign Languages Press, Peking, 1967.

[2] Chinese employment policy on women in urban production will be dealt with extensively in my book on "Women in Production in the PRC, 1949-78" to be published this autumn by the Scandinavian Institute for Asian Studies, Kejsergade 2, Copenhagen, Denmark.

[3] According to Chinese terminology an "urban" area is a place with either more than 75 percent of it's inhabitants engaged in nonagricultural pursuits or with a population over 2,000 at least half of which is nonagricultural. The distinction between "urban" and "rural" population is not equivalent to that between nonagricultural and agricultural population. A village with less than 2,000 residents may have a number of people in nonagricultural activities, all included in the rural population. Tung-chi kung-tso t'ung-hsin (Statistical Work Bulletin), No 12, 1955.12.17.

Already at the time of John Lossing Buck's study of the rural economy of China in the 1930's there was a great amount of underutilized labor in the countryside, especially during the slack season. Only 35 percent of the agricultural male population, 15–59 years of age, worked full time in agriculture. As many as 58 percent of the male peasants worked only part time in agriculture and were idle part time.[4] Certain characteristics of the utilization of marginal labor could be distinguished at this time.

The greater the number of busy seasons in agriculture in a region the greater the employment of the marginal labor force. Thus in North China with one to two harvests a year women, even during peak periods, played a negligible role in agriculture. On the other hand in South China, notably, in Kwangtung and Fukien provinces, women supplied up to a quarter of the labor force in the three to four annual harvests.[5] Earlier, women in areas with more harvests had more frequently unbound feet and had looser foot bindings and greater proportions of unbound feet the lower their class.

Facilitating the increased participation of women in agricultural production required at least partial solutions to problems of changing traditional views on the role of women in farm work and making practical arrangements for them to do such work. The main difficulties were first of all taboos and prejudices against women performing certain agricultural tasks. Views of the lack of working ability inherent in such peasant sayings as "when women dig a well the water dragon will be annoyed" or "when women transplant rice, no seedlings will sprout" had to be overcome by propaganda and education.

By arranging temporary childcare and urging other members of the household to assist, more mothers could be released for agricultural work. Other practical arrangements included encouraging formation of all-female production teams and locating women in worksites near their homes and in traditionally accepted tasks.

In contrast to the agricultural male population, women of poor peasant origin from the beginning played a crucial role in production teams, as compared to men of the same origin, because they were the most skilled of their sex in farm work, since poverty forced them to do farm work from childhood on and often in low and despised jobs such as collecting manure.

Among the women they were usually the most politically reliable as well as the most experienced in farming. In the male population, however, though the poor peasant might be politically the most trustworthy, he usually was not the most knowledgeable.

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[4] J. L. Buck, "Land Utilization in China. A study of 16,786 farms in 168 localities and 38,256 farm families in 22 provinces in China, 1929-33", 1937, reprint 1964, New York, p. 289 ff. (hereinafter referred to as J. L. Buck, 1964).

[5] Ibid.

In China in 1949 two types of areas existed defined by different criteria where the female participation rate was higher than the average; in the earlier mentioned areas with three to four harvests annually, reviewed in Buck's study, and in the old Communist-dominated areas where land reform was carried out in the 1930's, according to Chinese Communist accounts.

ORGANIZATIONAL CHANGES IN CHINESE AGRICULTURE

On June 30, 1950, the Agrarian Reform Law was enacted by the new regime. According to this law:

> The land ownership system of feudal exploitation by the landlord class shall be abolished and the system of peasant landownership shall be introduced in order to set free the rural productive forces, develop agricultural production, and thus pave the way for China's industrialization.[6]

After this land reform had redistributed land to over 300 million poor peasants, the new regime tried to widen and make permanent the traditional system of families cooperating during peak seasons in agriculture. This system of seasonal informal mutual help was through official encouragement converted into permanent mutual aid. The rationale for grouping peasant families into mutual aid teams on a year-round basis was to cope with the problems of unemployment in slack seasons and labor shortage during peak seasons. By developing subsidiary activities during slack seasons and coordinating agricultural work during busy seasons the problems of labor supply would be alleviated.[7]

On December 16, 1953, the Chinese Communist Party adopted a resolution, "On the Development of Agricultural Producers' Cooperatives." On June 30, 1956, collectivization of agriculture was introduced in the "Model Regulations for Higher-stage Agricultural Producers' Co-operatives." [8]

In contrast to the earlier agricultural producers cooperatives (APC), often referred to as lower APC's, the advanced or higher APC's required their peasant members to give up their major means of production such as privately owned land, farm implements and animals to the collective ownership of the higher APC's. In August 1958 the party passed a resolution on "The Establishment of the People's Communes in the Rural Areas." This meant amalgamation of the advanced APC's into larger administrative units known as rural people's communes. The main rationale for the formation of the people's communes was "the overall and continuous leap forward in agricultural production."

According to official Chinese claims, two-fifths of all peasant households were organized into mutual aid teams in 1953. In late 1955 three-fifths of all peasant households belonged to lower APC's, according to Communist claims, 1 year later after the big collectivization drive of 1956 practically all peasant households were included in higher APC's. In mid-1958 the first rural people's communes were organized. At the end of the same year more than 99 percent of all peasant households were members of rural people's communes.[9]

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[6] Land Reform Law of the Chinese People's Republic, 1950.6.28, in "Collection of Selected Laws of the Chinese People's Republic," pp. 127 ff.

[7] A. Donnithorne, "China's Economic System," London, 1967, p. 31 ff.

[8] Chao Kuo-chün, "Economic Planning and Organization in Mainland China." A documentary study (1949-57), vol. 1, 1959, p. 129 ff.

Table 1 (below) shows changes over time in name and size of planning units in Chinese agriculture.

TABLE 1.—CHANGE OF NAME AND SIZE OF PRODUCTION UNITS IN CHINESE AGRICULTURE, 1952–74

[In number of households per unit]

Line	Name of production unit	1952	1955	1956	1957	1958	1959	1960	1961	1953	1970	1971	1974
1	Mutual aid team	[1] 6	[1] 8										
2	Production team		8	7—		[2] 8, 6—	20						
3	Lower APC		28–40	20—	[2] 40 [1] 54								
4	Production brigade in higher APC				[3] 27								
5	Production brigade in RPC					30—	40						
6	Production team in RPC							20—	30	[1] 24			[4] 33
7	Higher APC			100–	[2] 300 [3] 337	[1] 170							
8	Large production brigade in RPC					250							
9	Production brigade in RPC						100–	[2] 350		[1] 171		[4] 220	[4] 233
10	RPC					[1] 4, 637				[1] 1, 622	[1] 2, 900		[4] 3, 346

[1] Average.
[2] Recommended.
[3] Sample.
[4] Preliminary estimate.
Abbreviations: APC=Agricultural Producers' Cooperative.
RPC=Rural People's Commune.

SOURCES

Kenneth R. Walker, "Planning in Chinese Agriculture," 1965, pp. 3–19, line 1–5, line 7 (hereafter referred to as K. R. Walker 1965).

Audrey Donnithorne, "China's Economic System," 1967, ch. 2–3, line 3: 1957=54 (hereafter referred to as A. Donnithorne 1967).

Frederick W. Crook, "The Commune System in the People's Republic of China, 1963–74" in Joint Economic Committee, Congress of the United States, "China; A Reassessment of the Economy 1975" (hereafter referred to as F. W. Crook, 1975), line 6: 1960–61, 1974, line 9: 1971, 1974, line 10: 1971, 1974.

C. S. Chen, "Rural People's Communes in Lien-chang," 1969, pp. 3–8, line 6, 9, 10: 1963 (hereafter referred to as C. S. Chen 1969).

Ed. N.-R. Chen, "Chinese Economic Statistics," 1967, pp. 54–61, 370–371, line 10: 1958, average for year-end 1958 (hereafter referred to as N.-R. Chen 1967).

Through all organizational changes in Chinese agriculture the smallest planning unit, first called the mutual aid team, then the production team, consisting of 6 to 8 households, remained almost unchanged in size up to 1959, when it was amalgamated into a larger basic unit.[10] This unit of 20 to 50 households was in 1955 established as a lower APC, and with the formation of the higher APC's was renamed a production brigade in the higher APC's. From 1958 onward it was made a basic planning unit in the people's communes. At first it was called a production brigade and later was referred to as a production team. This unit was often made up of a small village or part of a village.[11]

The higher APC from 1956 consisted of 100 to 350 households and from the establishment of the people's communes in 1958 was first renamed a large production brigade and later was called simply a production brigade in the commune. Since 1958 it was the intermediate level of commune organization.[12] Encompassing all aspects of rural life and including 1,500 to 5,000 households, the rural people's commune from 1958 was the largest planning unit up to that time and represented the highest level of planning at the local level. It replaced the township (hsiang) government as the basic unit of government administration.[13]

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[9] (I) State Statistical Bureau, "Wei-ta ti shih-nien" (Ten Great Years), September 1959, Peking, pp. 23–30. (II) N.-R. Chen "Chinese Economic Statistics," 1967, p. 371.
[10] See table 1 (above), lines 1 and 2.
[11] Ibid., lines 3–6.

Over time, names, tasks, and responsibilities have changed back and forth among the different levels of planning and production. The existence and endurance of a basic unit of at first 6 to 8 families and later of 20 to 50 families may be a clue to explaining both adaptability to change and also resistance to change. Though tasks and names of the production units changed, peasants were still working within their basic unit with their kinsmen or neighbors of the same village.

Within their production unit people could be organized for work according to sex, age, or skill. Because the basic division was made along family and village lines the impact of tradition would most likely be more strongly felt than if individuals were organized in the first instance along criteria like sex, age, class or skill or were frequently reorganized. Except for a very brief period in 1958 and 1959 this did not occur. During this brief period traditions were attacked more than in the preceding period, and also more than in the period following. Not until the Cultural Revolution in 1966, and from 1972, were these traditions again seriously questioned and struggled against. The attempts to implement the policy of equal work for equal pay for women and men illustrate the struggles between traditional values and new ideas.

EQUAL WORK, EQUAL PAY

Renumeration in Chinese traditional agriculture gave high values to certain necessary factors such as physical strength, while some other important traits such as experience and conscientiousness counted for less. Traditional male characteristics were usually overvalued, even when they were not of prime importance, while traditional female skills were for the most part undervalued. Only in regions specializing in sericulture could women earn more. Except for cultivating mulberry trees, sericulture operations, such as reeling and spinning of silk were exclusively women's work.[14] The income of peasant women in the 17th century from spinning silk thread for sale could match that of their husbands who worked in the rice fields.[15] In traditional China able-bodied women working full-time would usually get one-third to a half of what men could earn in agriculture.[16] Most women working in agriculture, however, were unpaid family workers.

Summary of major changes

Already in the 1940's the Communist women's movement propagated the implementation of the principle of equal pay for equal work. Both the Common Program of 1949 and the Marriage Law of 1950 stressed that women and men were equal socially, politically, and economically.

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[12] Ibid., lines 7–9.

[13] Ibid., line 10.

[14] Evelyn Sakahida Rawski, "Agricultural Change and the Peasant Economy of South China", 1972. p. 55. (II) Marjorie Topley, "Marriage Resistance in Rural Kwangtung" in ed. M. Wolf, R. Witke, "Women in Chinese Society," 1975, p. 67ff.

[15] Ibid., 141.

[16] Fei Hsiao-tung and Chang Chih-i. "Earthbound China. A Study of Rural Economy in Yunnan." London, 1948, p. 65 ff.

In the "Decision on the Development of APC's of 1953" the principle of equal pay for equal work was explicitly stated.[17] In the early 1950's the slogan of equal pay for equal work was used to mobilize women for work in agriculture. When the drive for more women in agricultural production gained momentum in 1955, some organized services, like temporary child-care facilities during busy season, were added in order to sustain a high level of female participation. Both equal pay for equal work and services were downplayed in 1957 and early 1958.

With the formation of the rural people's communes in late 1958 a massive social reorganization in the Chinese villages took place. Through setting up canteens, nurseries, kindergardens, and special teams for washing, sewing, mending, and other services, women could be released from their traditional duties and were thus freed to participate fully in production. The main stress during this period was on freeing women from their traditional burdens through organizational changes, while less stress was put on equal pay. In a period of reevaluation of values, self-sacrifice, devotion and working spirit were encouraged, not obsession with personal gain. Thus, the question of equal work, equal pay, though perfectly in line with the ideology, received less emphasis during this period.

The failure of the Great Leap in 1960 saw the closing down of the service organizations designed to relieve women of some of their traditional tasks. When resources became scarce a low priority was given to maintaining services that women traditionally had given free to society. Because old men still dominated the decisionmaking in the rural communes, women's and particularly young women's interests could be sacrificed without too much opposition. Women, however, still had to work in the fields, because a great many men were needed in capital construction projects. Women had to be kept in collective agricultural production, though no canteens and most child-care facilities were no longer available. By giving women equal pay for equal work they were expected to endure a double work burden, both participation in agricultural production as well as housework and childcare. This was to be accomplished through equal pay and positive revolutionary thinking. If women did not manage their double workload they had only themselves to blame. In some cases young married women were told to use their old mother-in-laws or women neighbors to solve difficulties in arranging their personal lives, that is child-care and household work. This was made a private problem of women. Production had to be given first place.

After the Cultural Revolution a directive from the CCP Central Committee of December 1971, followed by criticism by the Vice-President of China, Soong Ching-ling, started a new drive lasting through 1973 to implement the principle of equal pay for equal work in agriculture. A synthesis of earlier policies was put forward. Women were still needed in the fields, because many men continuously were required for farmland capital construction and commune industry. Therefore, women were to receive equal pay for equal work and were to be relieved of some of their double workload, while men were encouraged to help with household work. Neither by itself alone, the establishment of service organizations nor equal pay alone, could release enough women for agricultural production for sustained periods, but both measures in combination might produce the intended results. By these means it was planned to reduce the workload of women at home but not in the fields where they were needed in collective agricultural production. The interplay of ideology, scarcity of resources and demand for women's labor explains the shifting priorities given to the question of equal work, equal pay.

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[17] (I) "Hun-yin fa-chi ch'i yu-kuan wen-chien" (The marriage law and related documents). Legal Committee of the Central People's Government, 1950, Peking.

(II) Editorial, Theodore H.E. Chen, "The Common Programme of the Chinese People's Political Consultative Conference, September 1949, p. 36, in "The Communist Regime Documents and Commentary," 1967.

(III) *Chung-kuo chieh-fang-chu nung-ts'un fu-nu sheng-chan yun-tung* (The production movement of the village women in the liberated areas of China), chap. 7, ACDWF, Shanghai, 1949.

(IV) "Decisions on the Development of Agricultural Producers Cooperatives Adopted by the Central Committee of the CCP," supplement to *People's China*, 1954.4.1, p. 8.

The First Five-year Plan Period

In comparison to industry, the multitude of widely different nonstandardized tasks existing in agriculture posed greater problems in evaluation and comparison and were also more easily influenced by inherent traditional biases and ways of thought. To fight and change age-old values and prejudices was hard especially as the overwhelming majority of the rural cadres were male. Complaints were voiced in the press to draw the attention of the Women's Federation:

> No matter how good their work is, women are usually graded 2–3 points below men, and even in some places the labor of women was counted as only one-third the value of men's labor. Usually men can get Y 400 and women Y 350. Therefore some women even retreat from labor.[18]

Old way of belittling women had not disappeared.[19] That some work was traditionally done by women and therefore counted as light work still raised problems as well as the fact that even men doing relatively little work got the rewards of full-time able-bodied men:

> In Yin Lin county women usually get 7–8 labor points a day, while men usually get 12–13 points daily. First grade female labor gets less than third grade male labor. One of the male cooperative members, who is always absent, gets the same number of labor points as women, who attend every day. This is an unreasonable way of giving labor points. The female cooperative members even had a strike for one day. No matter how much we work the labor points are much less than those of a lazy man. But after summer planting, because of the introduction of a reasonable method of assigning of labor points they changed a lot. . . . The grade basis, however, for labor differs.
>
> (*a*) The grading is not according to requirements of skill and labor, therefore, one labor point for women is worth less than one labor point for men.
>
> (*b*) In addition standards for the quality and quantity of labor are set too high, therefore only a few people can meet the standard.
>
> (*c*) The division of labor is not according to heavyness of work or requirements of skill. Usually the kinds of work women customarily do were counted as low grade work. To harvest with a sickle is no lighter than plowing with a cow. But cutting with a sickle is counted as second, sometimes as third or fourth grade

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[18] For labor evaluation the workpoint system was used. Workpoints usually were calculated on a time-rate basis. Workpoints were awarded after the number of days a person worked in a month for the cooperative. The actual value of a workpoint was first determined at the end of each fiscal year when the share of the distributable income of the collective unit was computed.

"The phenomenon of looking down upon female labor is common; the women of South-West China give an article to Women's Federation of all ranks to emphasize the antifeudal propaganda and struggle, and to rectify deviations of labor cooperation groups who suppress women", *Hsin-hua jih-pao* (New China Daily), Chungking, 1952.8.4.

[19] "Women alone shall not be put in a production team because this can influence the progress of production," *Che-chiang jih-pao* (Chekiang Daily), 1956.8.12.

work, because it is usually done by women, but plowing with cow is always first grade work, because it is men's work.[20]

The traditional way of always regarding men's work as harder and therefore more valuable was hard to uproot:

> In Ching Teh chen, men do lighter work, while sailing men row while women paddle, but men get over 100 work points while women get only 35." [21]
>
> In an APC in Shansi Province on the division of work, women's work points are recorded lower than men's. Men plowing get 7.5 points, while women collecting manure get 5 points. Women then reported this to the party committee. The party branch secretary said that if women get more, men will get less. He said that women had to be skillful. To prove his point he forced the women to plow quickly for 3 days. The women were unused to plowing and got very tired and sick. This also happened to the women who walked behind the plow with manure. The party secretary won.[22]

Also, when doing the same work, women's work was scrutinized more closely and therefore sometimes regarded as of lower quality:

> In the Liang Yuan agricultural cooperative there were 4 women who had cut 2 baskets full of grass but were only given 2.5 work points for this, while male members got 4 points for 1 basket full of grass. . . The reason given for this was that the quality of the grass women had cut was poorer and the women's grass was not neatly arranged. . . When the women protested the man said that the women also were afraid of the smell of the cow's droppings and that they had trod on the new sprouts while cutting grass.[23]
>
> After taking part in agricultural production for 8–10 days, some women don't even get 1 labor point, because they are not counted as a full labor unit, only as 0.2 or 0.3 of a full labor unit. . . . In a certain village 3 women got 18 labor points after finishing 3 whole days jobs, but the cooperative group took away 12 labor points. As for male labor the maximum is six points a day, while these women each got 2 points for 3 whole days job. Therefore these 3 women weep. . . .[24]
>
> Village women did the same work as men, but they only got 4.5 work points while men got 10. When a woman objected about this to the leader, he got very angry.[25]

Not only were women as labor power basically rated lower than men,[26] women among themselves were also rated in different categories. This type of differentiation did not occur among men:

> In Fen Yi county, in a cooperative, women without children are given 1.5 works points, while those with children get 1 point. As a result of this their labor enthusiasm is low and what is more, work without pay is usually done by women.[27]

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[20] "We must carry through equal pay for equal work," *Kuang-hsi jih-pao* (Kwangsi Daily), 1955.12.30.

[21] The demand of all Kiangsi women activists in building socialism, "Never embezzle women's labor compensation," *Chiang-hsi jih-pao* (Kiangsi Daily), 1956.7.5.

[22] "Stand up for women cooperative members," *CKFN*, No. 9, 1956.

[23] See footnote 26.

[24] On the 3d session of the 1st People's Congress of the Sinkiang Uighur Autonomous Region speech by delegate Sai-li-ma-t'a-li-fu-wa, "Emphasize solving all problems in women's work," Hsin-chiang jih-pao (Sinkiang Daily), 1956.8.5.

[25] Editorial, "For men and women carry out, in earnest equal-work-equal-pay-system," Chiang-hsi jih-pao (Kiangsi Daily), 1956. 7.6.

[26] (I) "Let even more women because activists in socialist construction," Ho-pei jih-pao (Hopei Daily), 1956.12.14.

(II) "Correctly solve the problem of village women's work," Chiang-hsi jih-pao (Kiangsi Daily), 1956. 11.13.

(III) On the 3d session of the 1st People's Congress of the Sinkiang Uighur Autonomous Region, speech by delegate Sai-li-ma-t'a-li-fu-wa, "Emphasize solving all problems in women's work," Hsin-chiang jih-pao (Sinkiang Daily), 1956.8.5.

(IV) Speech to the 2d plenary session of the 1st Kwangsi provinced committee of the Chinese People's Political Consultative Conference, "Women's role in construction in Kwangsi," Kuang-hsi jih-pao (Kwangsi Daily), 1956.4.28.

(V) "Resolutely protest for the labor right of women," Chiang-hsi jih-pao (Kiangsi Daily), 1956.11.15. Speech by delegate Chang Pao-chen, on the the 5th meeting of the Kiangsi People's Congress.

[27] See footnote 25.

Many women, however, were not only questioning the old sex-typed work tasks, but were also trying to learn new skills and take up traditionally male types of work, as well as upgrading old skills.[28] Shortages of male labor have facilitated women taking up traditional male work tasks. In districts with labor shortages it was considered especially important to teach women agricultural skills. Women were not only to be mobilized together with men in agriculture, but,[29] here as well, sex-typed work could be questioned and women were allowed to learn traditional "male" skills, such as plowing.[30]

In 1954 the ACDWF again stressed the need to give women equal pay for equal work as a means of drawing more women into farm work.[31] In addition to propaganda and education about the equality of women and men as ways of carrying out the principle of equal pay for equal work,[32] examples of practical measures were given:

> In Shensi Province, in a certain village more than 30 women worked in silk worm breeding and earned more than Y80 for the group. With this sum they bought a cow and 20 raincoats for the male cooperative members and this changed the wrong view of the male cooperative members towards them, in regard to equal work equal pay.[33]

In a commentary on a collection of articles about cooperativization in late 1955, Mao Tse-tung gave renewed emphasis to the principle of equal pay for equal work to induce more women to work in society:

> To encourage the women to join in the work we must abide by the principle of equal pay for equal work, men and women alike.[34]

The realization of the principle of equal pay for equal work as a means for the further mobilization of women into farmwork was emphasized in connection with Women's Day in 1956:

> As for the problems about equal work, equal pay, we should make suggestions to the cooperatives and help them to carry out a reasonable way of recording work and establish reasonable work point regulation. We need to do propaganda work about the principle of equal work equal pay and fight against the phenomena of disregarding it. Help the cooperatives to break down the barriers that prevent women from taking part in labor such as giving fewer work points to women and the competition of strength between women and men.[35]

Officials of the Women's Federation especially attached great importance to stopping discrimination against women.[36] Over and again the benefits of abolishing wage discrimination against women were emphasized.[37] If women got equal pay for equal work with men, not only would their health be protected,[38] but feudal ideology would be dealt a blow.[39] Reports about the benefits of equal pay for equal work for women list more women active in work with higher work attendance with higher working spirit.[40]

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[28] (I) "We should reason things out and at the same time we have to set an example," Shen-hsi jih-pao (Shensi Daily), 1956.4.8.

(II) "Actively help and support women in their study of cotton planting," Shen-hsi jih-pao (Shensi Daily), 1956.4.29. Editorial.

(III) "Women why did you return to work" (in the countryside), Hsing Ying. Chung-kuo ching-nien pao (China Youth Daily), Peking. 1956.5.17.

(IV) "Who says women cooperative members can only do the weeding," Liu K'ai-k'e, Hsin-chiang jih-pao (Sinkiang Daily), 1956.6.14.

[29] "Insist on the directive for mobilizing male and female peasants together," HCKFN, editorial, 1950.9.15., No. 14 in Fu-nü kung-tso shou-ts'e (Women's Work Handbook), Shanghai, 1951, p. 63 ff.

[30] "In Tung Shan county, 3d district, Hsin Tien village, 200 odd women learn to use the plow, showing the difficulties caused by the shortage of labor in the village," Fu-chien jih-pao (Fukien Daily), 1952.2.15.

[31] ACDWF, "Instructions about current village women's work," KJJP, 1954.7.31, in HHYP, No. 8, 1954, p. 15 ff.

[32] "The Development of the Cooperativization Movement," Hsin-chiang jih-pao (Sinkiang Daily, 1955.1.2., by Yao Wen.

[33] "Calculating the production results of female cooperative members", Hsin-chiang jih-pao (Sinkiang Daily), 1955.5.21., letter published for discussion.

[34] "Socialist Upsurge in China's Countryside," Foreign Languages Press, Peking, 1957, p. 286.

[35] "Women of the whole country realize the draft for the whole country's agricultural development from 1956 to 1967," JMJP, 1956.3.9.

[36] Excerpt from a speech at the Second Women's Congress by Hou Chih, Chairman of the Municipal Women's Federation, "Shoulder the task of socialist construction," Shen-yang jih-pao (Shenyang Daily) 1956.4.13.

[37] "Manage well household work, practice equal work equal pay: Let women join agricultural production enthusiastically and happily," Ho-nan jih-pao (Honan Daily), 1956.9.9.

> In Pioneering Youth-brigade in the 2nd agricultural cooperative, in the past 22 women got 6 labor points a day. Now they get 8.5 points daily and the women's labor enthusiasm is raised.[41]
>
> Male cadres do not pay respect to women's labor. Usually male cooperative members get 12 labor points a day while female members get only 8 points. Male cadres insist on giving unequal pay for equal jobs. The vice-president of the cooperative society said the reason for doing this is: (*a*) for the benefit of creating a fine unity between male and female cooperative members, (*b*) for doing a good job of production, (*c*) so as not to hinder the labor activity of male cooperative members. Because of this unjust policy many women refused to attend to labor. After the cooperative society rectified this phenomenon "of unequal pay," all of the 65 women went to field work every day as a result. Before this the cooperative cadres estimated that the labor force was insufficient. After carrying out this policy, overfulfillment of work was completed ahead of time. This fact showed the wrong viewpoint of the male cadres and no excuse for that can be given now.[42]

Although strenuous efforts apparently were made, it did take some time to realize in full the policy of equal pay for equal work for women and men. In the APC's emphasis was placed on giving ordinary peasant women equal treatment with male peasants in work point enumeration. This heavy stress on the health, education, and training of one of the least privileged groups of society resulted in a certain neglect of another more privileged female group, the female cadres in agriculture. At the end of 1956, of 63,000 APC's in Shantung, fewer than one-third had carried out the policy of equal pay for equal work for female cadres.[43]

> For example: One male cooperative leader got 115 labor days subsidy as supplement, but the female leader only got 55 labor days for doing the same work. In another special district, the pay for male cooperative leaders is always 2–5 times that of the female cooperative leaders. Because of this unreasonable payment the working enthusiasm of the female cadres has been hindered. In a certain provincial women's federation, attention to equal pay for equal work is paid only to cooperative members and not to cadres. In the minds of many male cadres the idea of looking down upon women exists.[44]
>
> In Wen Chou district, Chüh county, according to the information we have received, the phenomenon of unequal pay for equal work even exists between female and male cadres. In these places the grading of labor points is not counted

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[38] "Feng Li agricultural producers cooperative. Be concerned about women's health and practice equal work equal pay for women and men," Chung-kuo ching-nien pao (China Youth Daily), 1956.8.23.

[39] The Investigation and Research Team in Farm Work of the CCP in the region south of Yin Ch'uan town. "Ways to solve problems of women going to work in the fields", Kan-su jih-pao (Kansu Daily), 1956.6.25.

[40] (I) "Work-more-get-more system" encourages female cooperative members." Ch'ang-sha jih-pao (Changsha Daily), 1956.6.26.

(II) "Hsi Shan cooperative employs equal work equal pay and the enthusiasm of female youth is heightened," Chung-kuo ching-nien pao (China Youth Daily), 1956.7.6.

(III) "Mobilizing women to participate in summer plowing has solved a great problem," Nei-meng-ku jih-pao (Inner Mongolia Daily), 1956.7.6.

(IV) "Sung Kang cooperative practices equal work equal pay for women and men. Female cooperative members are in high spirits," Chiang-hsi jih-pao (Kiangsi Daily), 1956.7.13.

(V) "After the policy of equal work, equal pay for women and men is carried out and child-care stations are established, the members of Hsia Nan district agricultural cooperative actively go out to work," Nan-fang jih-pao (Southern Daily), Canton, 1956.8.24.

(VI) "Develop the further employment of women on the production front," Kan-su jih-pao (Kansu Daily), 1956.9.22., Ch'i K'o-hsing.

(VII) "The only way to activate women is to carry out the policy of equal pay for equal work," Ho-pei jih-pao (Hopei Daily), 1956.12.12.

[41] "It is good to have equal pay for equal work and the labor enthusiasm of women is high," Ching-nien pao (Youth Daily), Liaoning, 1956.5.26.

[42] "Respect women's labor," Ch'ang-chiang jih-pao (Yangtse Daily), 1956.10.25.

[43] "Male and female cooperative cadres do equal work, but do not get equal pay in many agricultural cooperatives in Shantung. The Provincial Women's Federation suggests rectification of this during the autumn harvest distribution," JMJP, 1956.11.30.

[44] Ibid.

according to working ability or attitude. The labor points are only counted according to cultural level, therefore as a result the maximum the males receive is from 1,900–2,500 labor points a year, while maximum for females is 1,500 labor points annually. In this district only one female cadre reached this. The number of labor points that the female cadres can get is usually 1,200 and some even get only 1,000. In another village there are 5 cadres, who are not engaged in any kind of production. There is a male cadre who gets 2,000 points and his responsibility is not great. He is in charge of the 7th brigade, and he just visits there 3 times a month. On the other hand there are 2 female cadres, the president and the vice-president of the agricultural society. They both are grade A models, but each can only receive 1,000 labor points. Before becoming cadres they were full laborers, after becoming cadres they only got one-half of what they earned before. The cooperative members have already obtained equal pay for equal work, why not the cadres? According to the above information the system of unequal pay for equal work is employed because of feudal remnants in the minds of those who give the grades, the district leaders, not because of the fact that the different sexes put in different amounts of work.[45]

Insofar as remuneration of cadres was based more on cultural level (that is, level of literacy) than on actual work performed, female cadres continued to be paid less than their male counterparts. In the early years of the new regime women's generally much lower literacy levels compared to those of men were especially pronounced in rural areas. This hangover from the earlier period seriously hampered women's advancement on all fronts,[46] and, of course, also could serve as a justification for paying women less in general, even literate women. Discounting the possibility that most women cadres in rural areas were recruited from urban areas, the number of functionally literate rural women, about 1 percent of all peasant women, was too small to supply the number of women cadres needed in rural areas. As a consequence, many illiterate women were trained as cadres. For example, in Chahar Province in 1950, of 1,200 female cadres at the district level and above 51 percent were illiterate or semi-illiterate.[47] In the policy exams for cadres 32 women failed out of 77, while only 63 men out of 226 did not pass.[48] Plans were drafted, however, for women and for women cadres especially to catch up. In determining a long-term plan for women's work by the Provincial Women's Federation in Shensi in 1956, it was proposed that illiteracy among female cadres above the level of cooperative group leader should be wiped out within 3 years, while within 5 years illiteracy among women under 50 years of age should be eliminated.[49]

The crucial point here is that a higher incidence of illiteracy among women cadres as such seemed to have been used as an excuse for generally grading all female cadres lower, as the maximum a female cadre could reach here was much lower than that of a male cadre.

In the example quoted above women cadres apparently had both, more work and responsibilities but the basis for grading was only the cultural level (that is, level of literacy). It is interesting to note that in this case a higher degree of literacy was a male characteristic and thus was made the only base for grading, but both actual work performed and responsibilities assumed were disregarded.

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[45] "In agricultural society female and male cadres who do not take up productive work, must have equal pay for equal work," *Ch'ien-chin jih-pao* (Forward Daily), Kweilin, 1956.12.11.

[46] According to Buck's study of the 1930's less than one-half of the men and just 2 percent of the women in the countryside had ever attended school. While of the rural population about one-third of the men were functionally literate only one percent of the women knew enough characters to read a common letter. "Land Utilization In China." J. L. Buck (1937), reprint 1964, p. 373.

[47] Editorial, "Earnestly do a good job in women's work," Cha-ha-erh jih-pao (Chahar Daily), 1950.3.8.

[48] Ibid.

[49] Editorial, "Do a Good Job in Learning Skills," NCNA, Peking in *HHYP*, No. 6, 1950.4.15., p. 1446.

In the main report on the Third National Women's Congress, held in September 1957 in Peking, the Vice-Chairwoman of the All-China Women's Federation (ACWF),[50] Chang Yun, characterized the situation for women in the APC's by saying that "the principle of equal pay for equal work for both women and men is being gradually carried out." [51] Complaints, however were still being voiced in the press.[52]

In recalling the slogans used on the first women's day meeting in Canton in 1924, among which was "equal pay for equal work," an editorial on women's day in 1958 stressed that in China "these goals already earlier had been greatly overfulfilled and carried through." [53] In order to realize equal pay for equal work not only had male prejudices to be overcome but also those of women. In one case village women were told to abolish the following six superstitions:

> (1) To keep face (that is, to work means loosing face if you are a woman).
> (2) Fear of hardship.
> (3) Fear of being scolded by the husband.
> (4) The thought that after marriage your husband will earn for you, too.
> (5) Unwillingness to leave the children at home crying.
> (6) Fear of being ridiculed by others (because of having no production skills).
>
> These superstitions of women contribute to the fact that men get 9—9.5 labor points and for the same work women get 7—7.5 points. That greatly hinders the working enthusiasm of women. . . .
>
> Of all questions this one must first be solved. In order to change this we suggest abolition of the system of laying down different basic labor points for women and men. Instead decide the labor points according to quality and quantity of work. Also encourage skill-learning among women, with slower speed in the beginning but still giving relatively high labor points".[54]

The Great Leap Period

In late 1958 the great leap forward was being launched with the formation of the people's communes in rural areas. Through increased establishment of organized childcare, establishment of communal messhalls and service teams for shoe stitching and washing, women were to be relieved of their traditional tasks. Instead they were to become full producers on equal terms with men, and, of course, receive the same benefits.[55] By measuring women's work output compared to men's, equal pay could be carried through in one place, while still encountering resistance in another:[56]

> Many people use the intensity of work to put women in lower work point grades. The bad habit of looking down upon women is still very serious. Take for example the grades given in Tung hung people's commune. In October many people said that no matter how good a woman's work is, she shall not get over the third or fourth grade.[57]

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[50] At the 3d National Women's Congress in Peking in September 1957 the ACDWF changed its name to the All-China Women's Federation (ACWF).

[51] Chang Yun, Report to the 3d National Congress of Chinese Women, 1957.9.9, "Construct the nation and run the household with industry and thrift and fight for constructing socialism," JMJP, 1957.9.10–11, in HHPYK, 1957, No. 12, p. 95.

[52] (I) "The forum for health protection of women and children and equal pay for equal work," Ch'ing-hai jih-pao (Tsinghai Daily) 1957.1.17.
(II) A committee member delivers a speech, "We are against looking down upon women," Shen-yang jih pao (Shenyang Daily), 1957.6.5.

[53] Editorial, "Welcome to March 8, Women's Day," TKP, HK, 1958.3.8.

[54] The report about the experience of Kuang Ming people's commune on mobilizing women to take part in production, by a journalist of this paper, "To abolish the 6 superstitions of women and to insist on equal pay for equal work", Che-chiang jih-pao (Chekiang Daily), 1958.5.4,

[55] " Yung-fu Agricultural Commune Carries Out Equal Pay for Equal Work. Women's Labor Won Over Men's", Pao-tou jih-pao (Paotow Daily), 1958.8.9.

[56] Mo Yeh, "People's Communes and Women's Liberation", Kan-su jih-pao (Kansu Daily), 1958.11.16.

[57] Ibid.

During the autumn harvest, in 1959, in the continuing leap forward examples showed that unreasonably low pay to women for doing the same amount of work as men hindered women's work participation. By ending wage discrimination full mobilization of women could be achieved.[58] The party particularly stressed the necessity of adhering to the principle of equal work, equal pay for women and men,[59] which so far had "basically been implemented" in agriculture.[60]

Too much stress had apparently been put on details in giving fair wages for women, as the leading national daily in preparation for women's day in 1960 said plainly, that:

> Women of the whole country should continue to develop our tradition of building our motherland in a thrifty way and put the interest of our country first and our own second, cherish the Communist attitude of labour without arguing about the compensation.[61]

In an article on women's day capitalist countries were said to practice equal work but unequal pay for women and men. No reference was made to the situation in China in this respect.[62] Still in 1960 a full male labor power working 1 day in agriculture could get 10 points while a woman at most could get 6.5 labor points for the same amount of work accomplished.[63]

Crisis and Recovery

After the failure of the Great Leap in 1960, everybody was needed in the fields to increase production and ward off the food shortage developed during 3 consecutive years of bad weather, reinforced by mismanagement and administrative chaos.[64] To give women equal pay with men for equal work was regarded as one of the best means to further mobilize women for agricultural production.[65]

> In this production brigade men and women did the same job, but got different pay. If a man did fertilizer work he got 15 labor points, if a woman did it she got 5 labor points. Because of this female attendance was very low, only 180 women participated (of 338, in all).[65a] Then the commune held a meeting, demanded a change and got it. The basis points of women was raised from 4½ to 6½ and they got the same number of points as men. Because of this women's work attendance was raised to 80 percent.[66]

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[58] "Equal work for equal pay for men and women, teach production skills and arrange well the livelihood welfare; full attendence for women, greater enthusiasm for work", JMJP 1959.7.27.

[59] Ma-i-nu-erh, "Women's work under party leadership advances victoriously," Hsin-chiang jih-pao (Sinkiang Daily) 1959.9.21.

[60] (I) "Historical change of several hundred million rural women—from servant-like domestic laborers to social laborers," NCNA, Peking, 1959.9.22.
(II) Chu Tan-hua, "Without the CCP there would be no liberation of women," Chiang-hsi jih-pao (Kiangsi Daily) 1959.9.26.
(III) Tai K'o-yu, Vice Chairman of Szechwan Provincial Women's Federation. "Hail the mighty achievements of the Szechwan women's movement," Ssu-ch'uan jih-pao (Szechwan Daily) 1959.9.29.
(IV) Shih Chien "Ten brilliant years in the Kiangsu women's movement," Hsin-hua jih-pao (New China Daily), Nanking, 1959.9.24.

[61] "The National Women's Federation and 8 other organizations on the announcement of the commemoration of the 50th anniversary of March 8th," JMJP 1960.2.5.

[62] Cheng Chih-chow, "The road to women's basic liberation," JMJP 1960.3.8.

[63] "District Women's Federation is loved and respected by the masses," CKFN, No. 1, 1963.1.1., p. 3.

[64] (I) Ma Wen-jui, "The problem of labor power in building socialism in our country," Hung. chi (Red Flag), No. 5, 1961.3.1. (II) Editorial, "Women, contribute more to the efforts to win a harvest this year." JMJP. 1961.3.8. (III) "Agricultural requirements will be great for long time," Kuang-ming jih-pao (Enlightment Daily), in CCD, No. 58, p. 67 ff. (IV) "On the problem of labour distribution in industry and agriculture," Kuang-ming jih-pao (Enlightment Daily), 1961.11.20., in CCD, No. 60, p. 59 ff.

[65] (I) "Youth Communist Legue studies ways to help young women in getting work experience," Chung-kuo ch'ing-nien pao (China Youth Daily), 1961.9.3., Jui Chin county Women's Federation, work section, (II) "Equal pay for equal work for men and women in the Ch'ing hsi production brigade," CKFN, No. 11, 1961. (III) Hsiao Kan administrative district, Women's Federation and Ying Shan county work group. "Respect the opinion of women members, organize rationally the amount of fixed production," CKFN, No. 11, 1961.

[65a] Parenthesis mine.

[66] "Wholly adjust the members' basic salary, thoroughly solve the women's special difficulties, Chuh Chao Chao production brigade insisted on equal pay for equal work for men and women," Nan-fang jih-pao (Southern Daily), Canton, 1961.5.24.

Still wage discrimination of women continued. In one commune, for example, women outperformed men in rice planting. Therefore, the male peasants objected to women doing the same type of work as men, and the women did not get as many work points as the male commune members. While making an investigation, the party secretary in the commune discovered that such practices were still prevalent.[67] Documents from a commune in Fukien in 1962 showed that agricultural wages were still sex-differentiated. A male worker in the lowest class on the work point scale for men got the same pay, 6 labor points, as a female worker in the highest class for women.[68]

In teaching materials for women cadres, the seriousness of the question of equal remuneration was stressed.[69] Only through equal pay would more women participate in agricultural production.[70] In May 1964, a rural work symposium strongly recommended the adoption of the principle of equal pay for equal work.[71]

In a special dispatch in English on Women's Day 1965, Chinese women workers were said to enjoy equal pay for equal work, while peasant women "were adding to the family income."[72] More women were still needed for agricultural work, as male labor to a great extent was required for capital construction work.[73]

Among revolutionary changes recorded in model communes the introduction of equal pay for equal work played a prominent role.[74]

Post-Cultural Revolution Period

During the Cultural Revolution after the fall of Liu Shao-ch'i, the former Prime Minister, was accused in a Red Guard poster of having promoted wage discrimination against women.[75] Though women were still badly needed in the fields,[76] Liu Shao-ch'i was charged with confining women to the house.[77] The first provincial women's work conference in Kiangsi after the Cultural Revolution disclosed that:

> The renegade, hidden traitor and scab Liu Shao-chi did his best to oppose women taking part in the three great revolutionary movements and keeping them within the small circle of the family. . . . His remaining poisonous influence has not yet been eliminated. In some places, the phenomenon of neglecting women still persists. In certain places at least, they have not carried out the practice of giving men and women the same remuneration for doing the same work.[78]

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[67] JMJP; 1961.6.30., p. 4.

[68] Ed. C. S. Chen. "Rural people's communes in Lien-chiang, Documents concerning communes in Lien-chiang county, Fukien province, 1962-63," Stanford 1969, p. 14, tab. 5.

[69] Peking Women's Municipal Federation, propaganda department. Reference for Women's Federation on the commune in educating women cadres at the basic level, "Teaching materials on duties about work with village women," CKFN, No. 2, 1962.2.1.

[70] Pei-ching nung-ts'un ren-min kung-she kung-tso ching-yen (Working experiences of the Peking rural people's communes), CCP, Peking branch, Peking, 1963, p. 110.

[71] "Seriously carry out the "Equal work, Equal pay" Policy between Men and Women," Ch'ien Hsien (Front), No. 10, 1964.5.25., in SCMM, No. 436, p. 37.

[72] "Women's Status in Socialist China—Special for International Women's Day," NCNA, Peking, 1965.3.4.

[73] (I) "Announcement from the ACWF to every level of the WF about greeting 1965.3.8. international working Women's Day" 1965.2.16. CKFN 1965, No. 3, p.1 ff.

(II) Editorial, "Fully arouse rural women to take part in collective labor," Pei-ching jih-pao (Peking Daily) Oct. 11. 1965, in SCMP, Suppl., No. 148, p. 31 ff.

[74] (I) "Among Tai-chai women the political and ideological awareness is high," CKFN, No. 3, 1966.3.1 p. 11 ff.

(II) CKFN reporter, "Energetic young women of Yin hsi commune make revolution by changing heaven and earth," CKFN, No 2. 1966.2.1.

[75] (I) "Kweiyang large-character posters on big repudiation, Summary with quotations," Kweiyang 1967.9.6., in News from Chinese PRS, No. 224, 1967.9.14.

[76] "Village women are a great revolutionary force," Hung Ch'i (*Red Flag*), No. 10, 1969.1o.1., p. 76 ff.

[77] Yang Kuei-fei. "Mao Tse-tung's thoughts guide us women eternally to advance," Hung Ch'i (Red Flag), 1970, No. 5, p. 81.

[78] "Kiangsi provincial conference on women's work," Kiangsi PRS, 1970.11.27, 9:00 p.m., in U.R.S., vol. 61, No. 21, p. 281.

Enforcement of equal pay in agriculture was one of the main themes running through articles and broadcasts in connection with Women's Day in 1971.[79]

> Only by carrying out without any discount the policies of the party and enforcing the principle of equal pay for equal work between men and women can we fully mobilize the broad masses of women.[80]

In a report visitors claimed that still in mid-1971 at the model commune of Hung Ch'iao the maximum number of workpoints given for a day's work was set to 8.5 for a woman while that for a man was set at 10 a day.[81]

Though the emphasis was on continuing the policy of equal remuneration,[82] however, a warning was issued against "arbitrary equal treatment."[83] There was a limit to equality. In one people's commune in Kansu Province in order to enforce equal pay for equal work, the actual work performance of a women's team was measured against men's team, both performing the same type of work. Because the female group on the average accomplished more work and of better quality than the male, they were awarded the equal amount of labor points as the men but not more.[84]

New Campaign Period

In December 1971, the CCP central committee issued a directive on distribution in the rural people's communes. Article No. 3 stated that "women shall get an equal share for their work." [85] This directive led to renewed stress on giving women commune members equal pay for equal work.[86]

Soong Ching-ling, the Vice President of China, viewed continued wage discrimination against women as a feudal remnant: [87]

> Only when the feudal-patriarchal ideology is eradicated can we expect the sexual equality fully established. In order to build a great socialist society it is necessary to have the broad masses of women engaged in productive activity. With men, women must receive equal pay for equal work in production. Today in our country there are people's communes in rural places where women receives less pay than men for equal work in production.

After Soong Ching-ling's criticism reports in the media gave examples of unequal pay for women in agriculture and how to remedy the situation.[88]

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[79] (I) "Women are a vast force of revolution," Kiangsu PRS, 1971.3.8., 7:00 p.m., from an editorial in Hsin hua jih-pao (New China Daily), 1971.3.8. in U.R.S., vol. 62, No. 25, p. 339 ff.

(II) "Bring into play women's role in the three great revolutionary movements," Chekiang PRS, 1971.3.8., 6:30 p.m., in U.R.S., vol. 62, No. 25, p. 341 ff.

(III) "Communes in Chao-wu County implement the principle of 'equal pay for equal work' between men and women," Fukien PRS, 1971.3.9., 7:30 p.m., in U.R.S., vol. 62, No. 23, p. 304 ff.

[80] Ibid. (see footnote 79 III).

[81] "China! Inside the People's Republic." Committee of Concerned Asian Scholars, 1972, p. 272.

[82] "Ta Li yo brigade persists in equal pay for equal work," Hunan PRS, 1971.11.28, 7:00 p.m., in U.R.S., vol. 66, No. 8, 1972.1.28, p. 102 ff.

[83] Ibid.

[84] (Emphasis mine.) "An old production leader's plan," JMJP, 1971.11.29., p. 3.

[85] "Directive from the CCP Central Committee about questions of distribution in the rural people's communes," 1971.12.26. in Chung-kung yen-chiu (Studies on Chinese Communism), 1972 Sept., p. 98 ff.

[86] (I) "Anhwei women's activities," Anhwei PS (Provincial Service), 1972.1.5. 11:00 GMT in Daily Report FBIS-ChI-72-17, 1972.1.25., c 9.

(II) "Hunan women commune workers," Hunan PS, 1972.1.23., 11:00 GMT, in Daily Report, FBIS-CHI-72-101, 1972.1.27., D 1.

(III) Chin Chi-tsu, Huang Sung, discuss a wrong tendency in the question of allocation in the villages, "Men and women (do) equal work want equal pay," Hung Ch'i (Red Flag), No. 2, 1972.2.1., p. 59 ff.

[87] Soong Ching-Ling, "Women's liberation in China," Peking Review, No. 6, 1972.2.11.

[88] (I) Report of an investigation in Hopei, Hsuan-hua county Chen Chia-fang brigade, "How to carry through equal pay for equal work for men and women," Hung Ch'i (*Red Flag*), No 3, 1972.3.1., p. 89 ff.

(II) "Carry through for men and women equal pay for equal work," JMJP, 1972.3.6., p. 3.

Traditional conservative thinking still influenced cadres and commune members. It made them slight women and thus think that female commune members were not entitled to receive equal pay for equal work. In some places until the Cultural Revolution even women who worked well could only get half of what men received for the same amount of work. Some cadres used to put a ceiling on women's pay. Instances were recorded of cadres manipulating the work point system and thereby using the women as a reserve labor force. In busy seasons women would get higher pay and in slack seasons be kept out of the labor force through lower pay and restrictions on participation.[89]

In a commune in Chekiang, Tai shun county, Keng hsi production brigade a woman commune member who had picked 40 catties of peas was given 5 work points, while a male who had picked 32 catties was awarded 10 points. When the woman complained, she was accused of "putting workpoints in command." Frightened by these accusations, she had to accept being grossly underpaid. The same happened to women in Shensi, Heng Shan County, Lei lung van commune, and in Hopei, Hsuan hua County, Chen chia-fang production brigade. Women demanding equal treatment were told that they "practiced economism." [90]

One excuse put forward for continuing wage discrimination against women was that since every family had both women and men, no family would lose compared to another family.[91] It was realized that lower pay for women than for men for the same amount of work performed dampened women's enthusiasm for labor:

> Men and women (do) the same work but do not get the same pay; even if we removed the Tai mountain we would get 7.5 points (compared to 10 for a man), so who would like to sweat? [92]

On the other hand, some cadres were afraid that equal pay would hamper men's zeal for work, as this would lower their work points.[93] In some places in order to continue wage discrimination against women, they were prevented from comparing their work with men's by not being allowed to do or to learn certain types of jobs, "men's farmwork," which were more highly graded.[94] One example was given of a Shantung commune where the male secretary of the CCP had established the rule that the principle of equal pay would apply only to certain types of work.[95]

In order to abolish wage discrimination against women, different methods were employed. First and foremost, political education was stressed as a means of rooting out feudal thinking of attaching more value to men than to women. Women, too, had to overcome their inferiority complex. In regard to paying a member's contribution to socialist production, the actual quality and amount of labor would be made the main criterion. Through investigation, women's contribution should be compared to men's:

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[89] Ibid, footnote 88 I.

[90] Ibid, footnote 88II.

[91] Chin Chi-tsu, Huang Sung discuss a wrong tendency in the question of allocation in the villages, "Men and women (do) equal work want equal pay", Hung ch'i (Red Flag), No. 2, 1972.2.1., p. 59 ff.

[92] "Study the effects of the realized policy through the fertilizer transport by the brigade in Li-chuan Yuan village," JMJP, 1972.6.12., p. 1.

[93] Report of an investigation in Hopei, Hsuan-hua county, Chen Chia-fang brigade, "How to carry through equal pay for equal work for men and women", Hung ch'i (Red Flag), No. 3, 1972.3.1., p. 89 ff.

[94] See note 91.

[95] "A large army politically mobilized," JMJP, 1972.10.17., p. 1.

> A female and a male commune member took care of more than 100 pigs. Someone demanded that this woman commune member be given 10 labor points, but some male commune members were not convinced. The party branch secretary himself went to the pig breeding ground for 2 days. He found that this woman commune member did just as much work as the male member. Five males with labor power were sent to the pig breeding ground to acquire personal experience. After the male laborers had worked for a few days on the pig breeding station, all of them were very tired and all agreed that the woman commune member ought to have the same number of work points as the male member.[96]

Another way of ending wage discrimination was to limit the number of male commune members that could earn the maximum number of labor points, usually 10 points for 1 day's work. In one commune where half of the men used to get 10 points and the best one-tenth of the women got 7 points, a rearrangement was made. The number of men who could get over 8 points was maximized to one-fourth of the total.[97] In other communes, men were made to realize that equal pay meant a total increase in production as women's labor input was raised, and that therefore their work points would not be devalued.[98]

In addition, equal pay increased women's economic independence and status in the family. Women could not any longer be prevented by their men from participating in collective production on the pretext that their contribution to family income was negligible. Fights and quarrels which used to be common on economic issues, were mainly a thing of the past.[99]

In connection with Women's Day in 1972, it was stated over and again [100] that it was "necessary to implement seriously equal pay for equal work for men and women." [101] The stress on ending wage discrimination against women continued throughout the year,[102] and was especially pronounced at a number of regional women's work conferences.[103]

In celebrating Women's Day in 1973, it was especially emphasized that women and men must get equal pay for equal work. Particularly in the countryside, self-criticism has to be carried out in this respect.[104]

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[96] See footnote 93.

[97] Interview in Peking 1972.9.24. by Peter Nan Cho-Lee, at a Peking suburban commune.

[98] See footnote 93.

[99] Ibid.

[100] (I) "Developments keyed to international women's day," Tibet RS (Regional Service), 1972.8.3., 13.00 GMT, in Daily Report FBIS-CHI-72-49, 1972.3.10., p. E 1.
(II) "Hupeh CCP committee issues women's day circular" 1972.3.9., in Daily Report FBIS-CHI-72-48, 1972.3.9., p. D 6.
(III) "Roundup of provincial-level Women's day activities," Inner Mongolia RS, 1972.3.9., 11.000 GMT in Daily Report Huhehot FBIS-CHI-72-52, B 1, 1972.3.15.
(IV) Editorial "Laboring women are a great revolutionary force," Kwangsi Daily, Kwangsi RS, 1972.3.8., 11.000 GMT, in Daily Report FBIS-CHI-72-49, 1972.3.10., D 4.

[101] "Shensi issues circular on observing Women's day," Sian, Shensi, in Daily Report FBIS-CHI-72-46,

[102] (I) Short commentary, "Do well women's work," JMJP, 1972.3.19.
(II) Short commentary, "Do well women's work," JMJP, 1972.5.13.
(III) "Study the effects of the realized policy through the fertilizer transport by the brigade in Li-chuan Yuan village," JMJP, 1972.6.12., p. 1.
(IV) "A discussion meeting over recorded work points," JMJP, 1972.8.6.

[103] (I) "The women's movement in Kwangsi," Kwangsi RS, 1972.8.18. in Summary of World Broadcasts, BBC, 1972.8.23., FE 4074, B 11, p. 9.
(II) "Inner Mongolia holds regional conference on women's work," Inner Mongolia RS, 1972.11.20, 11.00 GMT, in Daily Report FBIS-CHI-72-224, 1972.11.27., Vol. I, No 229.
(III) "Inner Mongolia daily comment on women's work conference," Inner Mongolia RS, 1972.11.20, 11, Daily Report FBIS-CHI-72-230, 1972.11.28, Vol. I, No 230.
(IV) "Fukien holds provincewide forum on women's work," Fukien PS, 1973.1.9., 4:00 GMT, in Daily Report FBIS-CHI-73-10, 1973.1.15., No 10, Vol. I, C 2.

[104] Editorial "Working women are a great revolutionary force—commemorating 'March 8' International Working Women's Day," JMJP, 1973.3.8.

The English edition of Ta Kung Pao on Women's Day claimed that "equal pay for equal work by women is now a matter of course, which was unthinkable in China of 23 years ago." [105]

In preparation for the reestablishment of the Women's Federation in 1973, one of the main themes was an appeal to end wage discrimination against women and examples of how this was successfully done.[106] A number of women's congresses for reestablishing the Women's Federation on the provincial level were held over China from July through September in 1973. A theme running through all the congresses was adherence to the principle of equal pay for equal work for women and men.[107]

Since late 1973 concrete examples of wage discrimination against women in agriculture have not been mentioned in the media. Only success stories in ending discrimination have been recorded.[108] In a speech before the U.N. Commission on the Status of Women Chinese delegate Li Su-wen stated in January 1974 that the principle of equal pay for equal work was applied in the People's Republic of China.[109] In March, the leading national daily in an editorial on Women's Day issued a call that:

> In collective productive labor, the principle must be carried through of equal work equal pay for men and women.[110]

A year later in connection with Women's Day an article in English described in detail how a village managed to enforce equal pay for its women members.[111] In connection with Women's Day 1975, no reference was made to this question.[112]

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[105] "The past week," Ta kung Pao, English edition, 1973.3.8., p. 2.

[106] (I) Report on an investigation in Kiangsu, Ch'i tung County Luszu commune, production brigade 10 "Bring into fuller play the role of women as a labor force," Hung Ch'i (Red Flag), No. 3, 1973.3.3., p. 43 ff.

(II) "Shun ch'ang County committee seriously carries through the policy of equal pay for equal work for men and women," JMJP, 1973.5.13.

(III) "Women branch secretary who firmly takes part in work," JMJP, 1973.5.18.

(IV) "She reinforced her ideas on class struggle," JMJP, 1973.9.11.

(V) Peking Review correspondent, "Ett besok i Tung tings folkkommun" (A visit to Tung ting people's commune), Kinesisk Bulletin, No. 10, 1973, p. 17 ff.

[107] (I) "Tientsin convenes the 6th Women's congress, elects the 6th committee of the Municipal Women's Federation," JMJP, 1973.7.3.

(II) "The 3rd Hupei provincial Women's congress," Hupeh PR, 1973.7.12, in U.R.S., 1973.8.7., Vol. 72, No. 11.

(III) "Anhui, Hupei, Shansi, Kirin, Hopei call women's congresses, separately elect leading organizations for the Provincial Women's Federation," JMJP, 1973.7.20.

(IV) "Kwangsi, Kwangtung, Kansu, Tibet, Heilung kiang and Fukien, convene women's congresses, separately elect for every province and region the leading organization of the Women's Federation," JMJP, 1973.8.6.

(V) "Kiangsu, Ninghsia and Szeehuan convene women's congresses, separately elect three provincial and regional leading organizations of the Women's Federation," JMJP, 1973.8.16.

(VI) "Liaoning convenes women's congress the 2nd committee of the Provincial Women's Federation," JMJP, 1973.8.20.

(VII) "Yunnan opens women's congress, elects the 3d committee of the Provincial Women's Federation," JMJP, 1973.8.22.

(VIII) "Chinghai holds women's congress, elects the 4th committee of the Provincial Women's Federation," JMJP, 1973.9.4.

(IX) "Sinkiang Worker's Congress and Women's Congress separately elect the leading organization of the General Trade Union and the Women's Federation, every delegate determined to complete and struggle for the tasks proposed by the 10th congress (of the CCP)," JMJP, 1973.9.8.

(X) "Appeal to every women delegate, firmly complete and fight for the tasks proposed by the 10th Congress (of the CCP), the 4th women's congress of the Inner Mongolian Autonomous Region elects the leading organization of the Women's Federation," JMJP, 1973.9.30.

(XI) "Hunan holds women's congress and elects the leading body of the Provincial Women's Federation," NCNA, 1973.9.30.

[108] "Big changes in the status of women in the Chinese countryside," NCNA, Tientsin 1973.12.10.

[109] "Li Su-wen speaks at session of the U.N. Commission on the Status of Women," NCNA, 1974.1.14.

[110] Editorial. "Let all women stand up," JMJP, 1974.3.8.

[111] Chou Keh-chou "How our village got equal pay for equal work," China Reconstructs, No. 3, 1975.

[112] JMJP 1975.3.8., p. 1 and 2.

In celebrating Women's Day, 1977, K'ang K'e-ch'ing used a Mao quotation from the late 1950's, indicating that women in agriculture had yet to attain full equality with men: [113]

> Only when class society no longer exists, all cumbersome labor has been made automatic, and all agriculture has also been mechanized, will it be possible to realize equality between men and women.[114]

In the same paper an article written by the Hunan Women's Federation referred to the work earlier done by Chairman Hua Kuo-feng to promote the cause of giving women equal pay with men.[115]

In the new constitution adopted in 1978 by the People's Republic of China it was explicitly stated that:

> Men and women enjoy equal pay for equal work.[116]

In a report on the work of the government, February 1978, Hua kuo-feng in a speech stated that:

> All people's communes and production brigades must seriously apply the system of fixed production quotas and calculation of work-points on the basis of work done and must enforce the principle of equal pay for equal work irrespective of sex.[117]

The continued insistence that equal pay for equal work must be enforced in the rural people's communes indicates that this principle is not yet universally applied in the Chinese countryside. In perspective, 29 years is probably too short a period to produce a general belief among Chinese that women are the equal of men, when ideas to the contrary have dominated China for more than 2,000 years.

The Management of the Income of Female Cooperative Members

Since at least the early 1940's one theme running through all the speeches on women's emancipation by party officials and those of the Women's Federation was that productive work for women was regarded as a necessary precondition for emancipation.[118] This was contained in the notion that women would be liberated through working for and in society and by being able to handle the fruits of their own labor by themselves. In traditional China the husband had the full legal power to take all of his wife's income. This power was abolished in the new marriage law of 1950.5.1., where women explicitly were given full rights to their own income. But old habits still lingered. In many APC's the income of a wife was often automatically added to her husband's income, and given to him:

> In Chu Kuang cooperative the women did not get their names on the list for labor points, and therefore their labor enthusiasm decreased. This the cooperative did because it found it more convenient. When the women came to the accountant they did not find their names on the list. The labor points of the women had been added to and included under the name of their husband. Originally the women wanted to have an income of their own to use for their own expenses. When they asked their husbands for money (who had also got the incomes of their wives) then the husbands quarreled with them. Then, of course, the women were dissatisfied. They took part in collective labor to get economic independence and

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[113] JMJP 1977.3.8.

[114] Ibid., and the quotation above was cited in an article by Tsao Kuan-chun, Secretary of the National Women's Federation, "Further liberate women's labor power for the sake of quicker, better, and more to serve the construction of socialism," JMJP, 1958.6.2.

[115] Hunan Women's Federation "Under the leadership of Chairman Hua we women advance on the revolutionary road," JMJP, 1977.3.8.

[116] "New constitution of People's Republic of China," NCNA, Peking, 1978.3.7.

[117] Report on the Work of the Government delivered at the First Session of the Fifth National People's Congress on February 26, 1978, by Hua kuo-feng, "Unite and strive to build a modern powerful socialist country," Peking Review, No. 10, 1978.3.10., p. 26.

> equality, but now no women take part in collective labor, because they cannot use the money they earn. Therefore they are not liberated and do not go to work in the fields.[119]

An editorial in the organ of the Women's Federation written after the formation of the people's communes in 1958, pointed to the prevalence of the earlier transfer of a woman's income to either her father or husband, the so-called head of household:

> Especially after the cooperativization of agriculture the system of feudal patriarchy had begun to be shaken to its foundation. There were still many families, however, that relied mainly on their men's labor power to earn their income, and recorded the workpoints of their women members in the name of the heads of the families.[120]

If the wage was issued directly to the laborer, she could depend on her own labor for her basic means of living and did not have to rely on either her father or husband. In this way a woman's status in the family would be changed. When women were no longer totally dependent, the patriarchal system could be broken down.[121] In addition more women could be mobilized for farm work. Management of their own earnings was crucial as a motivation for them to work outside their own households.

> Lo Chah cooperative separately distributed the labor rewards to female cooperative members and so all of them were happy and attended to work.[122]

Sometimes the earnings of women were even considered as wind-falls with no connection whatsoever to women's motivation for work, even by the workgroup of a Provincial Women's Federation.

> The very best [way] is to put all earnings of women cooperative member together and use it collectively, instead of personally.[123]

Such views were common even though in 1956 women earned one-fourth of the total number of work points in agriculture.[124]

WOMEN AND OVERWORK IN AGRICULTURE

The overwork of women in Chinese agriculture is directly related to a combination of two factors:

(1) Massive mobilization of women to work in the fields.
(2) Inadequate supply of services to relieve women of their traditional tasks.

For this reason the campaign in 1956 led to a peak in the overuse of women's labor when mobilizing women for agricultural production without supplying adequate services. Though women were much more extensively mobilized for production in 1958, a concomitant establishment of services alleviated women's traditional workload.

When the peak demand of 1958–59 fell off, many of the service organizations were dissolved but also fewer women took part in production. During the early 1960's women's double workload was

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[118] Chung-kuo chieh-fang-chü nung-ts'un fu-nü sheng-chan yun-tung (The production movement of the village women in the liberated areas of China), chap. 7, ACDWF, Shanghai 1949.

[119] "Female cooperative members must manage by themselves their own labor reward", Chiang-hsi jih-pao (Kiangsi Daily), 1956. 8.30.

[120] "About the new stage in women's work." Special editorial, *CKFN,* No. 10, p. 1 (1959.5.16).

[121] *Ibid.*

[122] See footnote 119.

[123] "What's the appropriate way of handling the income of women cooperative members" *Shan-hsi jih-pao* (Shansi Daily), 1956.9.12.

[124] Speech by Comrade Chang Yün on the Chinese Women's 3rd National Congress, 1957.9.9. "Run the country and manage the household with industry and skill and fight to develop socialism", *CKFN,* No. 10, 1957.9.9., p. 10.

made a private women's problem. The women working in agriculture were encouraged to help each other, engage neighbors, relatives, or elderly women and employ positive revolutionary thinking.

During this period women's participation in agriculture returned to pre-1958 levels. Because of that those with the greatest needs for service, mothers with many small children, were either given only light assignments or were not mobilized at all. This in combination with a greater concern for women's health explains why the excesses of the 1950's were not repeated. The continued and heightened demands from the mid–1960's for rural women's labor increased the awareness of the importance of women for agricultural production. Therefore more resources, facilitated by good harvests, were channeled to services aimed at reducing women's work load at home.

In addition men were encouraged to share household chores.

Production Competition in the Early 1950's

Already in the busy summer season of 1951 reports had appeared of women being overworked in production competition.[125]

> 360 women had joined the work of digging a pond under the slogan "carry fast, carry much and no rest." The production competition was treated as a competition of strength. At least one pregnant woman was seriously-hurt and had a miscarriage 2 days later. In other place there are instances which show miscarriages resulting from overwork. A woman in Kung chou village worked more actively after being elected and recognized as an outstanding worker, until at last she fell ill. In the whole district 8 women had miscarriages from overwork, in addition to those who fell ill * * * *[126]

Likewise the campaign in 1955 to bring more rural women into production activities resulted in reports of women having miscarriages because of overwork, mostly from carrying too heavy burdens.[127]

> In Szechuan, March 22nd, a woman, 3 months pregnant, in Ching Hsi village when carrying grain slipped and fell on the road and had a miscarriage. April 2nd, a woman, Chou Hou Chen, pregnant 6 months, did too much work in grain-carrying and narrowly escaped having a miscarriage. Mao Hsin Chen of Hsin Ho village, 9 months pregnant, overworked carrying night-soil, had an abnormal delivery. Her baby died and her life was in great danger.[128]

In an editorial in the People's Daily women were told that not until the full socialization of agriculture could household work be socialized. Until then women had to take full responsibility for household work, even if they did outside work.[129]

In 1954 when the busy summer season was over the ACDWF particularly stressed that carrying too heavy things was a major factor contributing to miscarriages among women working in agriculture.[130]

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[125] "In production competition we have not properly looked after women's strength, in Kung city region eight women were overtired and had miscarriages." CFJP, 1951.7.27.

[126] Ibid.

[127] "In the lower reaches of Min river, the 5th group of the antiflood headquarters did not pay attention to the safety of pregnant women, making pregnant women miscarry contiuously." Fu-chien jih-pao (Fukien Daily), 1953.3.24.

[128] "Do not let pregnant women participate in heavy labor." *Hsin-hua jih-pao* (New China Daily), Chungking, 1953.5.14.

[129] Editorial, "Educate village women in the spirit of the general line of the state" *JMJP*, 1954.1.99.

[130] ACDWF; Instructions about current village women's work," KJJP, 1954.7.31 in HHYP, No. 8, 1954.

The 1956 Mobilization Campaign

The nearly universal establishment of agricultureal producers cooperatives (APC's) in 1956 and the collectivization of agriculture were closely connected with massive campaigns by the CCP to recruit more women for farm work. Because of these campaigns for farm work and to augment the number of workdays that women contributed, complaints mounted that women were being overworked. In the busy season most women had only 4 or 5 hours sleep at night according to one report.[131] Such slogans as "Take the moonlight and use it as sunlight" [132] or "Work in the fields in daytime and collect manure at night" were common.[133]

Besides household work and taking care of children, sewing, mending, and washing clothes and stitching shoes were traditionally regarded as responsibilities of women alone. When women were asked to work more in agriculture they were expected as well to fulfill their traditional duties. This opinion was clearly expressed in an editorial in the leading national daily:

> Participation in agricultural production is the inherent right and duty of rural women. Giving birth to children and bringing them up as well as preoccupation with household work are also obligations of rural women. These things set women apart from men.[134]

Sometimes village women were put under great pressure to take part in farm work irrespective of what was regarded as their household duties:

> Some cooperatives neglect the specific conditions of women. They criticize women who are pinned down by household drudgery and are not able to work in the fields as "loiterers" and "lazy bones". The request of a woman who had worked for 15 days in succession for a day's leave to do household work was rejected.[135]

According to some reports from APC's, especially singled out as good examples, up to 95 percent of all village women were taking part in farming.[136] As the summer season became increasingly busy, the China Youth Daily made a summary of letters of complaint from its readers on women being pushed too hard:

> Many letters have been received showing that many young people in agricultural cooperatives have overworked at farm tasks until some accident happened and women are no exception. From the above-mentioned letters, we know that agricultural production is in full swing and young people have become a reliable force, but some underlying problems surface; exhaustion, accidents, death, dropping out of school, miscarriages . . . Though this is not the general trend it is still very important. It not only influences production but also affects the health and knowledge of young people. It is a pity that there is no strong response among the cadres and they neglect the problems behind it, because they are too satisfied with their own success and imbued with the enthusiasm of the youth and the force of their movement. When people remind them of underlying problems

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[131] Speech at the 2d plenary session of the 1st Kwangsi Provincial Committee of the Chinese People's Political Consultative Conference, "Women's role in Kwangsi", *Kuang-hsi jih-pao* (Kwangsi Daily), 1956.4.28.

[132] "Take the moonlight and use it as sunlight", CKFN, 1956, No. 8.

[133] Editorial, "Protect positively the masses of village women taking part in agricultural work", Kansu-jih-pao (Kansu Daily), 1955.6.23.

[134] Editorial, "Protect the health of rural women and children", JMJP, 1956.5.16.

[135] Ibid.

[136] The Kirin Province, the Fourth session of the First People's Congress. (I) "Speech by delegate Wang Yi." *Chi-lin jih-pao* (Kirin Daily), 1956.1.26.
(II) "Kwangtung province village women give a fuller scope in production," *Nan-fang jih-pao* (Southern Daily), Canton, 1956.3.8.

> they always say it is not the general trend. And the problems are once again ignored. While doing work we have to grasp the general trend but at the same time we have to pay attention to the "dirty things" that appear from time to time. Though these things cannot become the main current, they can bring losses in our work, if neglected. So we should not indulge in the enthusiasm of the young people, but should correct them.[137]

The "dirty things" alluded to were the accidents, death, and miscarriages mentioned earlier. A week later the leading national newspaper, the People's Daily, carried one editorial and one article on the same day warning against forcing women to do too much work:

> Agricultural production is no doubt the important work of the countryside. But isn't doing a good job in household work, in looking after the children so that the beloved ones feel settled in work, isn't that also work meaningful to socialism?[138]
>
> The women's labor force participation rate has increased by 89.3 percent compared to the preceding year in "The 5 Stars People's Cooperative." But they do not look after women's health conditions and ask women to do hard work during menses or pregnancy. At the same time because women do too much work they have no time to do their household work. So the leaders criticized this wrong working method and decided: Once every 10 days, male cooperative members should be taught common sense about women and babies and women should be assigned to light work during their menstrual period. During pregnancy, if they cannot work, they should be given some work points. Women should be given time to sew, mend, wash clothes as well as to manage household work.[139]

After these articles in the leading national daily about abuse of women's labor and a recommendation that women be given time off for household work, reports poured in about malpractices and also about remedies. That an excessively heavy workload had been responsible for the increase in the number of miscarriages and premature births in at least one province had already been stated at the second plenary session of the First Kwangsi Provincial Committee of the Chinese People's Political Consultative Conference in April 1956.[140] According to all these reports women were apparently not relieved of their traditional work burdens when they had to take up fieldwork.

> We should actively suggest to the leaders that when they assign work, they should pay attention to the physical characteristics of women and children, especially those who are pregnant and weak. We must strengthen the education of ideology and education about women's health. But at the same time we must also correct women's attitude towards labor and rid women of the influence of the one-sidedness of the propaganda that "labor is glorious." [141]

Besides being compelled to spend their time doing excessive amounts of farmwork which endangered the health of some women, women also needed additional time to perform housework, which was still regarded as exclusive female responsibilities.[142] Though mother-in-laws could be induced to take over some of the work, they could not take over all of it. In the discussions on women's traditional work tasks either the young woman herself, her mother-in-law, or later collective actions, (that is, of an all-female group), figured as alternatives. Males were completely excluded as viable alternatives for relieving wives of some of the work in their own homes.

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[137] Editorial, "Talking about the problem of production safety for village youth," Chung kuo ching-nien pao 1956.5.8.

[138] Editorial, "Protect the health of rural women and children." JMJP, 1956.5.16.

[139] "A method to criticize not caring about women." JMJP, 1956.5.16.

[140] Speech at the 2d plenary session of the 1st Kwangsi Provincial Committee of the Chinese People's Political Consultative Conference "Women's role in construction in Kwangsi", *Kuang-hsi jih-pao* (Kwangsi Daliy), 1956.4.28.

[141] "In agricultural labor we should pay attention to the health of women and children", *Chung-kuo ching-nien pao* (China Youth Daily), 1956.6.6. Editorial.

[142] (I) The Investigation and Research Team in Farm Work of the CCP in the region south of Yin Ch'uan town, "Ways to solve the problem of women going to work in the fields", *Kan-su jih-pao* (Kansu Daily), 1956.6.25.

(II) Ching Chih, "Give female agricultural cooperative members time to do their household work", *Hsin-chiang jih-pao* (Sinkiang Daily), 1956.6.23.

That a woman could be ridiculed or abused for the natural functions of her body showed not only the heavy weight of old traditions of degrading and despising women, but also revealed how little effect the propaganda about new ideas on women had had so far and how low a priority these ideas received in regard to other targets such as increasing yields. It also revealed a completely male dominated power structure.

> Protect the health of women and children so that they could give fuller scope to their enthusiasm. Because of the coming of the high tide of socialist construction many problems have arisen. One of them is the prevention of injury and death of children and women. In some cooperatives women's menses and delivery leave have been made jokes subjects of ridicule. They are sometimes asked to work in the water during their menstrual period on purpose. Three cases of miscarriage in Hsin tse county, Wu yün cooperative were caused in this way.[143]
>
> Women's work enthusiasm is high. Because of lack of care many miscarriages have been caused. Also, young women for fear of being ridiculed by male workers, insist on taking heavy jobs. Young women, because they also lack sanitary knowledge, even work harder. During pregnancy and menstrual periods they work in cold water transplanting and carrying mud from the rivers to the field. This they are allowed to do because of lack of concern on the part of the Youth League Organization. Therefore we must strengthen sanitary work and make reasonable work allocations taking into account the health of women.[144]

The same newspaper published a summary of letters from readers on abuse of women's labor power.

> During pregnancy and menstrual periods women do the same jobs as men and their health is seriously damaged. For example in the "Youth Attack Brigade," in the Double Five agricultural group of Lo Ch'un of Hai Sing County, labor competition resulted in two pregnant women having miscarriages and bleeding a lot, and another bleeding uninterruptedly. In another place one woman began to bleed uninterruptedly, while another woman was vomiting blood after heavy bleeding. She had wanted to strive for equal pay for equal work between the sexes and therefore worked very hard. The leaders of the brigade and agricultural group regarded this as labor enthusiasm and did not prevent it. From another county and district: A women production brigade was sent to dig a well and this caused one woman to bleed uninterruptedly. One common demand of readers: pay attention to physical condition of women.[145]
>
> A women's work group was asked to carry earth from a newly dug well. No exception was made for a woman who had menses. Eventually she had serious bleeding; that is, menorrhagia. Fortunately she was given first aid and saved.[146]

In some places regardless of their physical condition, women were exhorted to participate in spring plowing:

> In Hsin Chü district in this year's spring plowing, because the district committee leaders made it compulsory and neglected to show any concern for women this spring plowing had very bad consequences. According to incomplete statistics, 40 pregnant women from March to June had miscarriages or premature deliveries because of exhaustion caused by plowing work.[147]
>
> From spring plowing up to the present, we have cases of miscarriage, premature deliveries and menorrhagia. These occurred in various agricultural teams. In 4 districts of 3 counties 33 women had miscarriages. These were caused by: lack of concern in the leadership, lack of sanitary commonsense among female cadres,

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[143] Editorial, "Protect the health of women and children, use the women masses to develop more glory and heat", Chiang-hsi jih-pao (Kiangsi Daily), 1956.6.21.

[144] Editorial, "We must abolish this phenomena", Ching-nien pao (Youth Daily), Liaoning, 1956.6.17.

[145] Summary of letters from the readers, "To protect the bodily health of young women," Ching-nien pao (Youth Daily), Liaoning, 1956.6.17.

[146] "Protect the bodily health of young women!" The Demands of Youth, Ching-nien pao (Youth Daily), Liaoning, 1956.6.17.

[147] "The evil result of paying no attention to women's work," Kuang-hsi jih-pao (Kwangsi Daily), 1956.7.3. by Yang Tai-ch'ün, Hsu Ju-Lan.

> women wanting to compete with men or wanting more labor points, or women being too shy to talk about these problems (about pregnancy, etc.).[148]

During the height of the summer season, a correspondent of the People's Daily summed up reports from Szechuan and Hopei on miscarriages resulting from excessive employment of pregnant women in field work.[149] By taking greater care in assigning work to women,[150] by establishing and enforcing female labor protection,[151] and thereby especially caring for pregnant women, the abuses should be stopped.

> A pregnant women's group was set up and organized to do light work. Within 5 months 12 pregnant women had safely left the group and 7 new members had entered it. Since the pregnant women's group was formed all the babies have been safely born.[152]
>
> The Chung shua production cooperative gives 10 days of supplementary wages for women who give delivery from July this year.[153]

To prevent women from working excessively long hours in the field and at home, time should be set aside for women's housework and private sideline production.[154] Examples were published in the press on how to employ female labor in a reasonable way.[155]

In a report in the press that sums up the results of the campaigns to mobilize women for farmwork, there are indications that among some women opposition to cooperativization developed as a consequence of the excesses of the mobilization campaign. The report explicitly demanded that:

> Through praising the advanced elements (in production) carry out collectivist education among women, because after cooperativization many women do not love public property.[156]

After the busy summer season was over, a summing up of the dire consequences for women of the excesses of the campaign to increase participation in farmwork was made for Liaoning Province:

> According to incomplete statistics for counties in Liaoning province, there were 689 miscarriages in 46 counties, 594 women with uninterrupted menorrhagia during their monthly periods in 41 counties, 117 women vomiting blood in 38 counties, 25 women who died because of hard labor in 14 counties. In discussing these figures we accuse the cadres of lack of care. Many housewives took part voluntarily in production in order to increase income, but many cadres made participation in production compulsory for women. Another contributing cause for the appearance of these figures, is that some women want to earn more labor points, work hard and neglect their health. The cadres must check on women's motives for wanting to work and emphasize work style instead of actual results.[157]

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[148] "Pay attention to the protection of the bodily health of female group members," Hsin-chiang jil.-pao (Sinkiang Daily), 1956.7.27.

[149] The paper's own correspondent, "We can't again give in when unusual things in the villages happen and women and children are injured and killed." JMJP, 1956.8.12.

[150] "Mobilizing women to participate in summer plowing solved a great problem," Nei-meng-ku jih-pao (Inner Mongolia Daily), 1956.7.6.

[151] (I) "Women labor protection regulations set up," Chung-kuo ching-nien pao (China Youth Daily), Peking, 1956.8.4.

(II) "Feng Li, APC: Be concerned about women's health and practice equal-work equal-pay for women and men," Chung-kuo ching-nien pao (China Youth Daily), Peking, 1956.8.23.

[152] "An agricultural cooperative forms a pregnant women group," Chung-kuo ching-nien pao (China Youth Daily), Peking, 1956.8.11.

[153] "Women APC members get supplementary wages during maternity leave," Hsin Su-chou pao (New Suchow Daily), Kiangsu, 1956.7.21. Mao Pao-kan.

[154] (I) "Manage household work well, practice equal-work equal-pay for women and men. Let women join agricultural production enthusiastically and happily," Ho-nan jih-pao (Honan Daily), 1956.9.9.

(II) "Southern Kiangsi decides to order village women to develop domestic sideline production." (From a conference by the Provincial Women's Federation, Aug. 28 to Sept. 3, 1956). Chiang-hsi jih-pao (Kiangsi Daily). 1956.9.11.

[155] "The use of women labor power in Red Flag Cooperative in Lu Chai district," JMJP, 1956.9.9.

(II) "Give models for village women," Hsi-an jih-pao (Sian Daily), 1956.9.20.

(III) "Develop the further employment of women on the production front," Kan-su jih-pao (Kansu Daily), 1956.9.22., by Ch'i K'o-hsing.

[156] "Vanguard cooperative pays attention to the ideological education work of women," Kan-su jih-pao (Kansu Daily), 1956.11.24.

[157] "Talk of figures", Liao-ning jih-pao (Liaoning Daily), 1956.10.3., by Li Chiang.

After the flood of reports about women having miscarriages, bleeding, falling ill and even being killed by overwork that cadres forced women to do, the stress on taking part in farmwork was toned down. At that time women were to be given more time for household work.[158] The number of working hours were not to be set too high and were allowed a certain degree of flexibility: [159]

> Pay attention to women's specific condition and arrange their working hours, considering that: (I) Those who have no mother-in-laws should be given time to cook, wash clothes, water vegetables, feed pigs and look after children, and (II) time should also be given to feed poultry and grow vegetables.[160]
>
> Don't force women to overwork. During their delivery period allowances should be given to them according to regulations. In doing household work cooperation and mutual help between neighbours are also important.[161]

Special attention was to be given to women during busy seasons in agriculture [162] and women who were particularly maltreated.[163] During the Third Village Women's Work Conference for Shantung Province, October 16–24, 1956, it was especially emphasized that:

> Because too much stress is put on the advantages of women's joining production, concrete difficulties that they suffer are neglected. Therefore the targets are set too high and the tasks cannot be accomplished. When mobilization of women for work in the fields is overemphasized, side-line production is neglected. In this way the contradiction between household work and field work cannot be settled.[164]

Arranged by the ACDWF from December 15 to 25, 1956, a special "forum on work among women in rural areas" summed up the results of the increased mobilization drive and its effects, positive and negative, on women.[165] All agreed that the number of women activists had greatly increased and that women had increased the length of their workdays as well as were performing a wider variety of tasks. In the words of the forum:

> In connection with the participation of women in production instances were reported in which women's labor was employed in excess * * * in correcting the deviation of paying no heed to the special physiological and physical characteristics of women but merely stressing the mobilization of female labor power and setting too high a target for work demanded of women. * * * The ages and

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[158] (I) A meeting for the cadres of the Women's Federation of all districts in the Peking suburban area, "Decide on the tasks from now on in women's work for all districts", Pei–ching jih-pao (Peking Daily), 1956.10.12.
(II) "Give women time for making winter clothes, women cooperative members are very glad," Chung-kuo ching-nien pao (China Youth Daily), Peking, 1956.11.14.
(III) "Resolutely protect women in their labor right", Chiang-hsi jih-pao (Kiangsi Daily), 1956.11.15. Speech by delegate Chang Pao-Chen, at the 5th meeting of the Kiangsi provincial people's congress.

[159] Speech at the 2nd Women's Representative Conference of the Sinkiang Higher Autonomous Region, by Wu Ch'ien-chang, secretary of the CCP committee of the Sinkiang Higher Autonomous Region, "Command all the women forces in the Autonomous Region to construct socialism", Hsin-chiang jih-pao (Sinkiang Daily), 1956.10.23.

[160] On the 5th meeting of Kiangsi provincial people's congress, the people's delegates from the province, Liu San-Ying and Li Yu-hsia call on village women, "We must pay attention to women's special conditions and arrange production time," Chiang-hsi jih-pao (Kiangsi Daily), 1956.11.2.

[161] On the 5th meeting of the Kiangsi Provincial People's Congress speech by delegate Chou Han-chen "Something about the protection of female labor power and the looking after of the special benefits of female cooperative members," Chiang-hsi jih-pao (Kiangsi Daily), 1956.11.10.

[162] (I) "In Autumn plowing and harvest pay attention to the health and safety of women and children," Hsin-hua jih-pao (New China Daily), Nanking, 1956.10.30.
(II) T'ang Yi-min "The live-stock-breeding cooperative pays attention to women joining production," Hsin-chiang jih-pao (Sinkiang Daily), 1956.12.22.
(III) "Protect labor power and raise the attendance rate, in Chu Chi district, Wai Ch'en village a cooperative pays attention to female labor protection work," Chien k'ang pao (Health Paper), 1956.11.30.

[163] "Women with specific problems should be given help," Nung-min pao (Peasants Daily), Sungchiang, 1956.10.28.

[164] "Our Province gathers to the 3rd Village Women's Work Conference investigate and solve the problems of production and household affairs for women," Shan-hsi jih-pao (Shansi Daily), 1956.11.1.

[165] ACWDF, "Forum on work among women in rural areas," NCNA, 1956.12.26.

physical conditions of women, their domestic duties and the needs of production must all be properly considered in asking for and deciding on plans for the production tasks to be assigned to women.[166]

In a concluding note summing up the village women's work conference, the People's Daily especially stated:

> The idea of simply mobilizing women into production is not correct. They should also pay attention to their concrete circumstances. Praise the women who do well both in work and in household management.[167]

The attitude and lack of action on the part of the ACDWF about the excesses during the height of the cooperativization campaign was first criticized half a year later by a forum on women's work. Shen Tzu-chin, secretary of the ACDWF secretariat, said:

> Much work has been done by the ACDWF but the Federation lacks foresight in regard to some work for women and this is very important. The Federation concerns itself too much with small things as if it is afraid of revealing contradictions. For example, at the height of the agricultural cooperativization drive cases of death and injury of women were reported because some women were employed too much, but the Federation only sent a report to the higher levels and circulated in the organization a report but did not talk publicly about the problems and did not invite the expression of opinions from the general public to solve the problem.[168]

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[166] "Demands by the ACDWF on a discussion meeting on village women's work for cooperation of agricultural cooperatives in using women's labor," JMJP, 1956.12.28.

[167] Ibid.

[168] "Nonparty leaders in women's work hold forum," NCNA, Peking, 1957.6.6.

The Relaxation of Demands in 1957

The intense propaganda in 1956 to attract more women to agriculture, gave way in 1957 to greater concern for the difficulties encountered by women during the previous year. More time was to be set aside for what was called women's "duties"—household affairs, child care, shoe- and cloth-making, since at that time the socialization of these "duties" received low priority and, therefore, the means were not available to relieve women of these heavy burdens.

As more than 100 million women had already been drafted into farmwork, no urgent need was felt to mobilize the remaining women, as they were usually weaker, older, more unskilled, with many small children, or looking after an already working mother's offspring. Thus, immediate propaganda gradually decreased as fewer women were needed. This was also expressed in a speech by Yang Shün-tung, Vice Minister of Agriculture, at the Congress of Representatives of Family Relations of Workers and Staff, held in Peking June 3–12, 1957.[169]

Already in the National Program for Agricultural Development, drafted January 23, 1956, article 39 stated that agriculture had to absorb some of the urban unemployed.[170] At the First National People's Congress in June 1956 Ma Wen-jui, Minister of Labor, had expressed concern over growing urban unemployment and had advocated a policy of sending the unemployed to rural areas to take part in agricultural production.[171]

In June 1957, Vice Chairman of the State Planning Commission, Sung P'ing, further elaborated the need for rural areas to absorb excessive urban workers for a long time to come.[172] In August 1957, Wang Kuang-wei, Assistant Director of the State Planning Commission and specialist on agricultural problems, discussed how to organize agricultural labor power, pointing out that not only in the short run but also for a long time to come agriculture would not only have to create employment for the rural population but also to absorb surplus manpower from the cities.[173]

Earlier it was indicated that agricultural labor power was gradually to be transformed into industrial labor. Therefore, in the future some rural population was to be urbanized. For the time being, however, and also for a long time to come, the organization of rural labor power was to occur in agriculture. In the long run there would not exist a labor surplus in rural areas, though in some regions there might be such a surplus. Apart from that, large amounts of part-time labor power and subsidiary labor power were available in each region.[174]

Thus, at the Third National Congress of Chinese Women, September 1957, the upgrading of household work was made the main theme as there were few new jobs available to women. The chief slogan was

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[169] "Speech by Vice Minister of Agriculture, Yang Shün-tung" in "Ch'üan-kuo chih-kung chia-shu tai-piao hui-i chu-yao wen-chien" (Important documents on the national representative congress of dependents of staff and workers) by the Women's Work Department of the All-China General Trade Union, Peking, 1957, p. 76 ff.

[170] Communist China 1955–159. Policy Documents with Analysis, Harvard University Press, 1962, p. 126.

[171] Ma Wen jui, Minister of Labor, "Wages, labor conditions and employment," NCNA, Peking, 1956.6:29, in CB. No. 405, 1956.7.26., p. 1 ff.

[172] Sung P'ing, "Talk on employment questions," Hsüeh-hsi (Study), No. 12, 1957, June, p. 25 ff.

[173] Wang Kuang-wei, "How to organize agricultural labor power," Chi-hua ching-chi (Planned Economy), No. 8, 1957.8.9.

[174] Ibid.

"Manage household work with industry and thrift." [175] In the words of Chang Yun, Vice-Chairwoman of the ACWF, who delivered the main report of the congress:

> Chairman Mao Tse-tung recently told us that coordination of industry and thrift is necessary in running the household and the cooperative, in loving the country, the cooperative and the family. Hence management of the household with industry and thrift must be seen as an important part of the country's construction with industry and thrift, and the *basic* means for women to help the country in socialist construction and to build new socialist families.[176] (emphasis added.)

In regard to peasant women, Chang Yun stressed the importance of auxiliary production:

> Second, in the family active development of all types of sideline production. Such production is suitable for women. Especially in rural areas sideline production is a considerable part of the total family income. Thus, since the beginning of the campaign to develop all types of economy, great importance has been given to family sideline production. Many women are actively working in breeding of pigs and poultry and striving to develop all types of sideline production.[177]

As few more women were needed in allocation of rural labor power, references were made to the great amount of time required for household labor and sideline production. Likewise more attention was to be paid to concrete obstacles and women with weaker labor capacity:

> In rural areas women's labor power must be used reasonably according to their capacity and ability, and the plans of the local agricultural cooperatives and local conditions. Some of the women must participate mainly in agricultural auxiliary production, and others must take part mainly in auxiliary family production.[178]

As problems of urban unemployment became more serious, more than 2 million urban school graduates and over 0.8 million urban cadres were "sent down" (*hsia-fang*) to rural areas in 1957.[179]

In these circumstances pressures to enlist more women in agriculture decreased. Women were still exhorted to participate in agricultural production but simultaneously concern was shown for their total work burden.[180]

Women were still told to work and assured that concern for their health would not be neglected.[181] In an editorial in *People's Daily* on the busy season in 1957 a warning was issued not to overwork women.[182]

> Not enough attention has been paid to women's labor power and this results in casualties. . . . In many places it still happens that women and children are destroyed. . . . We must give education to men and women about safe production and women's health, especially during menses, pregnancy, and delivery periods. Women should be given time to rest.

In a local cadre forum in Shantung Province in 1957 it was disclosed that some of the injustices inflicted on women still existed, such as wage discrimination, overwork by women resulting in miscarriage and also a lack of child-care facilities. In the words of the forum:

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[175] Editorial, "Mobilize the women masses to reconstruct the country and manage household affairs with industry and thrift," JMJP, 1957.9, in HHPYK, 1957, No. 12, p. 118ff.

[176] Report to the 3rd National Congress of Chinese Women, Chang Yun, "With industry and thrift build the country and manage the household, and fight to build socialism," JMJP 1957.9.10. and 1957.9.11. in HHPYK, 1957, No. 12, p. 95 ff.

[177] Ibid.

[178] Ibid.

[179] John S. Aird, "Population Growth and Distribution in Mainland China," in Joint Economic Committee, Congress of the United States, An Economic Profile of Mainland China, 1967, p. 387 (hereafter referred to as J. S. Aird, 1967).

[180] "Mother of 5 children made over 200 workdays," Ho-nan jih-pao (Honan Daily) 1957.3.8.
(II) Wu-lan Chairman, Inner Mongolia Autonomous Region Women's Federation, "Women of all nationalities in Inner Mongolia moving ahead," Nei-meng-ku jih-pao (Inner Mongolia Daily) 1957.4.27.

[181] Editorial, "Give full scope to women's socialist enthusiasm," JMJP, 1957.3.8.

[182] Editorial, " Reasonable use and arrange village women's labor power," JMMP, 1957.3.26.

> After women take part in labor, problems arise about carrying out the policy of equal pay for equal work. In a certain village the female production group leader worked just as much as the male leader. She got only 500 labor points, while he got 1,500 points. Both were cadres. There was no paying attention to the special benefits for women. It was a general neglect of women's welfare. In some villages women did (I) agricultural work (II) household work and (III) needle work, while male laborers only did the first and worked only during the day and neither cooked nor did any needle work.
>
> There had been no special care for pregnant women. During the last half year 120 miscarriages have already occurred because of excessively heavy work for women. All these miscarriages occured in Chiao County alone, in Shantung Province Some of the women must bring the children with them to the hillside, when working because there were no child-care facilities.[183]

By means of collective arrangements some of the traditional duties of women could and should be lightened, as for example through greatly expanding the child care facilities.

The Great Leap Period

The formation of the rural people's communes in 1958 meant a reorganization of rural life. Canteens, child care stations, and service teams were to release women from domestic duties for agricultural production. Though part of women's workload was lightened, even more was added. This was particularly so because an increasing number of men were drafted for farmland capital construction projects. Women had to shoulder more of the agricultural tasks and also some of the heavier work earlier done by men, like pumping water. In addition women were asked to participate in mass labor projects, like building dams, and terracing fields. In some villages up to 15 percent of the women suffered injuries in the work of regulating rivers and mountains, because they were inexperienced and not accustomed to the tools used.[184]

The demands for more women to participate in production were combined with calls for greater protection of women.[185]

Because men were engaged in farmland capital construction projects, women were to fill the resulting labor shortage in agriculture.[186] In order to accomplish this the Tai Yen hung commune employed three methods:

(I) They used the woman leader and the woman brigade leader as backbones to hold meetings to mobilize women, and criticized in big character posters the male brigade leader for looking down upon women.

(II) They made reasonable arrangements for labor distribution, gave work close to home and easier work to women. For hard work male members were sent to help women.

(III) They established nurseries and creches.[187]

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[183] Forum by female cadres from 8 counties express their opinions, "What are the contradictions that village women must solve," Ta-chung jih-pao (the Masses Daily), Tsinan, 1957.5.15.

[184] Tsao Kuan-chun, NWF secretary, "A further step to liberate women's labor power, for the sake of quicker, better, and more to serve the construction of socialism," JMJP, 1958.6.2.

[185] (I) "ACWF message to every level of the WF about March 8th, International Women's Day", JMJP, 1958.2.18.

(II) T'ien Hsiu-chuan, ACWF secretariat, "Promote women's work in Ho wen hsien," JMJP, 1958.6.12.

[186] (I) "Progress and make great use of developing women in socialist construction," JMJP, 1958.11.12.

(II) "Emancipate women labor force," Pao-tou jih-pao (Paotow Daily), 1958.8.9.

[187] Ibid., footnote 186 II.

As a consequence of this policy in many communes women had to do a full day's work in the daytime in agriculture, and in the evenings still shoulder heavy housework.[188] In 1959 warnings were issued against overwork and provisions were made by the sixth plenary session of CCP Central Committee to assure everybody of 8 hours of sleep and 4 hours of meals and rest every day.[189]

In a speech T'an Chen-lin, a member of CCP Central Committee, outlined the future for women's employment:

> This year the women of China played a great role in the great leap, especially in agricultural production. This situation will develop and women will take up the duty of becoming the principal force in agricultural production. * * * In general these industrial departments (of iron and steel) use mostly male labor power and offer few types of work that women workers can do. Therefore, up to a certain level of socialist construction most women will have to take up agricultural production.[190]

Ts'ai Ch'ang in a Women's Day speech in 1959, stressed health protection for women.[191] According to one source 9 health protection centers were in existence in 1949, compared to 4,315 in 1958.[192] In an editorial on Women's Day in 1961 it was especially stated that village women were to be given 6 to 8 days of rest every month.[193] Labor protection for women was particularly needed during the busy farm season in order not to damage women's health through overwork.[194] Through increased labor protection women would contribute more to agricultural production:[195]

> There are still some production team leaders who do not pay sufficient attention to labor protection of women. They continually stress the fulfillment of production quotas before implementing the policy of labor protection for women. In addition, there are some young production team leaders who are not experienced or knowledgeable and don't understand how important it is to protect women's labor. Some young women production team leaders surge ahead in production, but do not dare to surge ahead in protecting the women of their teams. Because of this the policy of labor protection for women is not fully carried out and therefore both women's health and the production of the team are affected to a certain extent.[196]

In a report to the Third Women's Representative Conference of Kwangtung Province in March 1962, Chou Wan-yu, Chairman of the Kwangtung Women's Federation, stressed the importance of combining increased demands for women's labor with labor protection work. In some places this problem had not yet been solved.[197] Women were told to increase the participation in agricultural work, but not at the expense of their health because that would harm both them and the long-term interest of production.[198] The models given, however, for women to emulate were women or women teams that through a combination of utter devotion to work and self-sacrifice created miracles in the form of bumper harvests.[199] In this way double messages were given to women. They were told to take care of their health and not endanger it through overwork. The labor heroines, however, always set the collective interest first and sacrificed their own interests for increased production, sometimes even their own life.[200]

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[188] (I) "Yung-fu agricultural commune carries out equal pay for equal work. Women's labor won over men's," Pao-tou jih-pao (Paotow Daily), 1958.8.9.
(IF) CKFN special commentary, "Discussing the new stage of the women's movement", CKFN, 1959.5.-16., p. 1 ff.

[189] "Speech by Comrade T'an Chen-lin at the All-China conference of women activists in socialist construction," CKFN, 1959.1.1., p. 6 ff.

[190] Ibid.

[191] Speech by Ts'ai Ch'ang, "Start the leap of this year and make it bigger, better, and more complete," Shen-hsi jih-pao (Shensi Daily), 1959.3.8.

[192] "Several hundred millions of women released from household labor; became a brave main force in production," Chung-kuo ching-nien pao (China Youth), 1959.9.23.

[193] Editorial, "Women contribute more to the efforts to win a bumper harvest of crops this year," JMJP, 1961.3.8.

[194] Ibid.

[195] "Women's work zeal is stimulated by proper labor protection", CKFN, No. 4, 1961.4.1.

[196] "Improve further the work of labor protection for rural commune members," CKFN, No. 8, 1961.8.1.

[197] (I) Report by Chou Wan-yu, Chairman of the Kwangtung Women's Federation to the Kwangtung Women's Third Representative Conference, "Unite the broad masses of the whole province, hold high the three red banners and strive for the victory of socialism," Nan-fang jih-pao (Souther Daily), 1962.3.27.
(II) "The decisions of the Third Women's Representative Conference of Kwangtung Province," Nan-fang jih-pao (Southern Daily), 1962.3.27.

During the Cultural Revolution, the Women's Federation was dissolved as well as the Communist Youth League and the trade unions. During the height of this period, 1966–68, revolutionary spirit was stressed in women's work as the main factor contributing to the solution of all women's problems.[201]

A regional conference for women's work in Huhehot, Inner Mongolia, November 6 to 17, 1972, stressed that it was "necessary to conscientiously implement the labor protection policy and pay attention to solving women's vital problems." [202]

The Women's Federation was reestablished at a series of provincial conferences in 1973. In women's work, the conferences stressed the following four points:

(1) Training of women cadres.

(2) Realization of the policy of equal work equal pay for women and men.

(3) Strengthening of health protection for women and children.

(4) Encouragement to share household chores between women and men.

In addition the promotion of late marriage and family planning was emphasized as well as education on changing existing habits and customs.[203] Now Mao's teaching from the 1950's could be reversed.[204] "Whatever women comrades could accomplish, men comrades should be taught to accomplish, too."

Number of Women Engaged in Agricultural Production

The policy of the CCP was to increase agricultural production through the combined effects of institutional changes and increased labor inputs, thereby using labor more intensively and drawing traditionally marginal groups into the labor force, such as the young, the old, and women. In regard to the employment of women, (*a*) more women were needed in agriculture, and (*b*) each women was required to work more. We will first discuss (*a*) then in next part (*b*). The policy of the CCP has over time been to increase the number of women working in Chinese agriculture. In connection with drastic changes or crisis particular emphasis has been out on woman taking part in farmwork. The collectivization campaign in 1956, the formation of the rural people's communes in 1958 in combination with a complete reorganization of rural life and the great crisis 1959–61, all witnessed special drives for drafting more women for the agricultural front. The three periods all show more women taking part in production then either before, in between, or just after. After the great crisis of the early 1960's, a pattern began to emerge well known to many industrializing countries. Men were particularly recruited for the development of both land improvement, "farm land capital construction," and rural industries, while women were left in the most primitive and unproductive sector, here the agricultural sector.

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[198] "Announcement from the National Women's Federation to every level of the Women's Federation about greeting of March 8, International Women's Day," 1965.2.16., CKFN, 1965.3.1., No. 3, p. 1.

[199] Ibid.

[200] (I) "Tach'ai spirit Tach'ai women," JMJP, 1965.3.8.

(II) "Women take out revolutionary work efforts, welcome the new upsurge in production," JMJP, 1965.3.8.

(III) Sun Wei-shih, Newsletter from Tach'ing, Hung-ch'i (Red Flag), No. 12, 1965.11.11.

(IV) "The women of Tach'ing oilfield play a revolutionary role," NCNA, 1966.3.5.

(V) "Give more thought to others than to oneself," NCNA. 1966.10.25.

(VI) Speech by Ts'ai Ch'ang, NCNA, "Learn from the revolutionary spirit of the workers dependents in Tach'ing oilfield," JMJP, 1966.2.26.

(VII) "Women fight for emulating the models, for carrying through the Third Five Year Plan. Hold high the red banner of Mao Tse-tung thought, like Tach'ing and Tach'ai," JMJP, 1966.9.9.

[201] (I) Editorial, "Chairman Mao's books are the highest directives for women's work," CKFN, No. 7, 1966.7.10.

(II) "Class nature of the problems of women must not be written off," CKFN, No. 8, 1966.8.10.

(III) "Learn from the splendid examples of the People's Liberation Army and study Mao's work in a big way," CKFN, No. 11, 1966.10.17.

(IV) Editorial, "Long live Chairman Mao's revolutionary line," CKFN, No. 12, 1966.11.7.

(V) Shih Sung-ch'ing. "Proletarian dictatorship is the life of revolutionary women," WHP. 1968.7.27., p. 4.

[202] "Inner Mongolia holds Regional Conference on Women's Work," *Inner Mongolia RS* in Mandarin, 11:00 GMT, 1972.11.20. in FBIS-CHI-72-229, No. 229, vol. 1, p. F 1, 1972.11.27.

[203] See footnotes 106 and 197.

[204] A quotation from the works of Mao Tse-tung that appears on the front page of JMJP, 1978.3.8.

In table 2 (below), two approximations have been made of the total number of women aged 15 to 59 of the agricultural population. This table gives in absolute numbers approximations of the maximum number of women that can possibly be employed in agricultural work at any one time.

TABLE 2.—TOTAL NUMBER OF WOMEN 15 TO 59 YEARS OLD IN THE AGRICULTURAL POPULATION OF CHINA 1929–33, 1949–78

[In millions]

År	Estimate		År	Estimate	
	I	II		I	II
1929–33	81–96	92–109	1964	127–139	144–161
1949	109–121	124–137	1965	129–141	146–164
1950	110–122	125–139	1966	131–144	148–167
1951	111–124	127–141	1967	134–148	153–172
1952	113–125	128–142	1968	137–151	156–175
1953	114–127	130–145	1969	140–155	159–180
1954	116–129	132–146	1970	143–159	163–185
1955	119–131	135–149	1971	147–164	167–190
1956	120–132	139–150	1972	151–168	171–194
1957	122–134	138–152	1973	154–172	175–200
1958	121–133	138–151	1974	157–177	179–206
1959	121–131	137–149	1975	161–181	182–210
1960	120–131	136–148	1976	164–185	186–214
1961	123–132	139–153	1977	167–188	189–218
1962	124–134	141–155	1978	170–190	192–221
1963	125–136	142–158			

NOTES AND EXPLANATIONS FOR TABLE 2

Definitions

"Agricultural population". The definition of "agricultural population" ranges from the most narrow definition including (a) only those in agricultural pursuits, to including (b) those both engaged in agricultural pursuits and subsidiary occupations jointly, to the widest definition used in Communist literature, including also (c) those solely engaged in subsidiary occupations (according to Liu, Yeh, 1965, p. 183).

According to J. L. Buck (1964, p. 290, table 1), those falling under category (c) made up 12 percent of the total of (a), (b), and (c). Estimate I includes categories (a) and (b) while estimate II encompasses categories (a) to (c).

"Working age"—Articles in Chinese often refer to people having working capacity (*yu lao-tung neng li*). When the above-mentioned term is used it is usually translated in Peking interchangably into "able-bodied" or "working age." In J. L. Buck's study for 1929–33, men 15 to under 60 years of age were defined as able-bodied men; that is, having full working capacity.[1]

In Communist literature, a more precise definition is sometimes used for the agricultural labor force. Women aged 18 to 45 and men aged 18 to 50 are counted as a full labor power, while all youth 16 to 17 years of age and women aged 46 to 55 and men aged 51 to 59 are considered a half labor power.[2]

Thus, the expressions "women of working age," "able-bodied women," and "women with working capacity" would roughly correspond to women 15 to 55 years of age, when referring to women in Chinese agriculture. Sometimes an even wider range of 15 to 59 years is employed when referring to women in general. Employing the range 15 to 59 years instead of 15 to 55 years means that 1 to 2 percent more of the women will be included.

To facilitate comparisons over time, gender and type of work we have employed the age range 15 to 59 years as the working age.

Calculations for the years 1921–33

According to J. L. Buck (1964, p. 377, calculated from table 14) women of age 15 to 59 made up about 23 percent of the total population in China 1929–31. We assume this percentage was valid for the whole period 1929–33. J. L. Buck classified 489 million people as peasants (p. 363). This figure he regarded as very high, but still much less improbable than the other figure of 300 million peasants which he suggested was far too small. Therefore we employ 400 million on the low side, and 475 million on the high side. Of a farm population of 400 to 475 million women aged 15 to 59 made up about 23 percent which would mean 92 to 109 million women, when categories (a)–(c) are included in estimate II and 12 percent less for categories (a)–(b), (see above) which would mean 81 to 96 million.

Calculations for the years 1949—60

The data are derived from my forthcoming dissertation and from C.-M. Hou (1968), p. 342, table 5. The agricultural population was derived from his estimate I and II of the nonagricultural population. Hou's estimates of the agricultural population included only categories (a) and (b) listed in our estimate I, which was for 1949 74.5 to 77 percent, for 1950 74 to 76.5 percent, for 1951 73.3 to 75.8 percent, for 1952 72.6 to 75.1 percent, for 1953 71.9 to 74.4 percent, for 1954 71.5 to 74 percent, for 1955 71.6 to 74.1 percent, for 1956 70.9 to 73.4 percent, for 1957 70.8 to 73.3 percent, for 1958 68.9 to 71.4 percent, for 1959 67.6 to 70.1 percent, and for 1960 66.3 to 68.8 percent of the total population.

For our estimate II of categories (a)–(c), we have assumed that (a) and (b) still made up 88 percent of the total of (a)–(c) as it did in J. L. Buck's study (see above). Thus we have used the percentage for estimate I and multiplied it by a factor of 1.136 leading to an agriculture population of 84.6 to 87.5 percent in 1949, of 84.1 to 86.9 percent in 1950, of 83.3 to 86.1 percent in 1951, of 82.5 to 85.3 percent in 1952, of 81.7 to 84.5 percent in 1953, of 81.2 to 84.1 percent in 1954, of 81.3 to 84.2 percent in 1955, of 80.5 to 83.4 percent in 1956, of 80.4 to 83.3 percent in 1957, of 78.3 to 81.1 percent in 1958, of 76.8 to 79.6 percent in 1959, and of 75.3 to 78.2 percent in 1960.

Calculations for the years 1961–78

The Chinese have over time referred to an agricultural labor force constituting about 80 percent of the total. In this figure they also have included those solely engaged in subsidiary production, category (c). J. L. Buck in the 1930's found that this category made up 12 percent of the whole agricultural labor force (see above). This percentage is more likely to have increased than decreased for the period 1961–78 compared to the 1930's. Thus we assume that at least 12 to 14 percent constitutes category (c).

Assuming an agricultural population, composed of categories (a)–(c), of 76 to 80 percent of the total population, and deducting category (c) (12 to 14 percent from 76 to 80 percent) leads to an agricultural population of 67 to 69 percent, of the total population. This 67 to 69 percent is the base for estimate I (a–b), while estimate II (a–c) is based on a 76 to 80 percent range. These two estimates would also be in line with Alexander Eckstein's estimates in *China's Economic Revolution*, 1977, p. 230, where he stated that even under the most extreme assumptions the agricultural labor force could not be less than 60 to 70 percent while the wider Chinese definition included 75 to 80 percent.

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[1] J. L. Buck, 1964, p. 294.

[2] According to Chi-Ming Hou, "Manpower, Employment and Unemployment" in ed. Eckstein, Galinson, Liu, Economic Trends in Communist China, 1968, p. 339 (here after referred to as C.-M. Hou, 1968).

In table 3 below, Chinese data have been computed on the percentage of women, it was claimed, were working in Chinese agriculture in different types of areas up to 1960. Most of the estimates were published in Chinese by the Chinese national dailies and in publications by the Chinese Women's Federation. A few figures were found in local Chinese newspapers.

TABLE 3.—PROPORTION OF WOMEN WORKING IN AGRICULTURE OF ALL WOMEN OF WORKING AGE IN THE AGRICULTURAL POPULATION IN CHINA, BY TYPE OF AREA, AND DURING BUSY SEASON, 1929–33, 1948–60

[In percent]

Type of area	1929–33	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
Backward			50—	20–40										
Average	30+ *32–53			50+ 60	60	60 60–80	60 60–70	60–80	*54–59	*67–79 60–80	*65–80	90	90	90
Model			80	80 90	90	80–90 90	80–90			90		100		
Busy season		50–90	80–90		70–80						70			76–78
New liberated areas			30–50	20–40		20								
Old liberated areas			50–70 50–80	50–70		40–50								

Note: (1) + means more than. (2) — means less than. (3) ± means about. (4) * means data explained in the text after the table.

NOTES AND EXPLANATIONS FOR TABLE 3

DEFINITIONS

See under table 2.

SOURCES

Backward areas

1949—"Review of women in agricultural production in 1949," *HCKFN*, No. 8, 1950, reprinted in *HHYP*, Vol. 1, No. 6, 1950.4.15, p. 1449.

1950—(I) Ts'ai Ch'ang, Chairwoman of the ACDWF "China's women-active builders of New China" in "*Chinese Women in 1950*", ACDWF, 1950, Peking, p. 5.

(II) "ACDWF announces directive to organize women to participate in spring tilling," *JMJP*, 1950.4.6.

Average areas

1929–33 30+. J. L. Buck, 1964, p. 371.

1950 (I)—See above "backward areas" 1950 for the first figure (50+).

(II)—the second figure (60): *Hsin Chung-kuo ti fu-nü ch'ien-chin* (New China's women are advancing), Liu Mien-chih, Peking 1953, p. 15 ff.

1951—Ibid.

1952 (I)—Ibid. for the first figure (60): Teng Ying-ch'ao, Vice Chairman of the ACDWF, "Women of China make further progress", *CFJP*, 1952.6.24.,

(II)—Teng Ying-ch'ao "Women of new China advance and advance again to commemorate the full three years of the establishment of the PRC", *JMJP* 1952.9.24.,

(III)—Teng Ying-ch'ao, "China's women advance", *People's China*, No. 23, 1952.12.1.,

(IV)—Wang Keng-chin, "The great achievements during the last three years in China's agriculture", *HCKFN*, No. 10, 1952 Oct., p. 28,

(V)—Teng Ying-ch'ao, speech at the 2nd All-China Women's Congress, "A basic summing up of the Chinese women's movement during the last four years and the tasks from now on", *HCKFN*, No. 5, 1953, p. 8 ff.,

(VI)—For the second figure (60–80): "*Women of China*" (in English), International Department of the ACDWF, Foreign Languages Press, Peking, 1953, March, p. 26.

1953 (I)—For the first figure (60): Hsiu Chih, "The women of China on the construction front", *TKP*, H.K., 1954.10.1.,

(II)—For the second figure (60–70): Huang Wei, "Some important questions concerning the mobilization of women to take part in agricultural production," *HCKFN*, No. 9, 1953.

1954 (I)—"New China's women have acquired equal status with men", *KMJP*, 1954.9.28,

(II)—"The happy sisters", *WHP*, 1955.10.1.

1956—Editorial, "Reasonably use and arrange village women's labor power", *JMJP*, 1957.3.26.

1958—All-China women's work conference decides on the general tasks for present women's work, "Increase communist education and promote the liberation of thought of the women masses, mobilize the mass of women to actively participate in socialist construction", *JMJP*, 1958.8.3., p. 4.

1959—"Women of rural China on the road to complete liberation", NCNA-English, 1960.3.1.

1960—"Congratulate our women on their merit in doing agricultural work and produce more crops on a large scale", *TKP*, Peking, 1961.3.8.

Model areas:

1949—"Review of women in agricultural production in 1949" in *HCKFN*, No. 8, 1959 in *HHYP*, Vol. 1 No. 6, 1950.4.15, p. 1449.

1950 (I)—For the first figure (80): "ACDWF announces directives to organize women to participate in spring tilling", *JMJP*, 1950.4.6.

(II)—For the second figure (90): *Hsin Chung-kuo ti fu-nü ch'ien-chin* (New China's women are advancing), Liu Mien-chih, Peking, 1953, p. 15 ff.

1951—Ibid.

1952 (I)—For the first figure (80–90): Teng Ying-ch'ao, speech at the Second All-China Women's Congress, "A basic summing up of the Chinese women's movement during the last four years and the tasks from now on", *HCKFN*, No. 5, 1953, p. 8 ff.

(II)—For the second figure (90): See above *model areas* 1950, II,

(III)—Teng Ying-ch'ao, "Women of New China make further progress", *CFJP*, 1952.6.24.

(IV)—Teng Ying-ch'ao, "Women of New China advance again and again to commemorate the first three years of the establishment of the PRC", *JMJP*, 1952.9.24, p. 2.

(V)—Wang Keng-chin, "The great achievements during the last three years in new China's agriculture", *HCKFN*, No. 10, 1952, Oct., p. 28.

(VI)—Teng Ying-ch'ao, "China's women advance", *People's China*, No. 23, 1952.12.1.

1953 (I)—Huang Wei, "Some important questions concerning the mobilization of women to take part in agricultural production", *HCKFN*, No. 9, 1953, p. 9 ff.,

(II)—Hsiu Chih, "The women of China on the construction front", *TKP*, H.K., 1954.10.1.

1956—Editorial, "Reasonably use and arrange village women's labor power", *JMJP*, 1957.3.26.

1958—See above Average areas for 1958.

Busy season

1948 (I)—Comrade Ts'ai Ch'ang's speech on the work and tasks for the women in Northeast China" in *Tung-pei ti-i-tz'u fu-nü tai-piao ta-hui hui-k'an* (Conference print on women's 1st representative conference in North East China), 1949, p. 15 ff.

(II)—"Put women to great use in industrial and agricultural production in Northeast China" in *Hsin chung-kuo ti hsin fu-nü* (New women of new China) by ACDWF, 1949, p. 20 ff.

1949—Editorial, "Earnestly do a good job in women's work," Ch'a-ha-erh *jih-pao* (Chahar Daily), 1950.3.8. in *HHYP*, Vol. 1, 1950.4.15, p. 1447.

1951—Teng Ying-ch'ao, "*The women's movement in New China*", speech by Teng Ying-ch'ao, Oct. 1951, published by ACDWF in English in 1952.

1957 (I)—"Historical change of several hundred million rural women—from servant-like domestic laborers to social laborers", *NCNA*, 1959.9.22, Peking.

(II)—"Several hundred million village women, released from household labor, become a main force in production", *Chung-kuo ching-nien pao* (China Youth), 1959.9.23.

1960—"The women of Shansi participate in the autumn field management", *JMJP*, 1960.8.19, p. 4. The figures refer only to Shansi province in the busy season.

New liberated areas

1949—"Comrade Teng Ying-ch'ao gives a speech in commemoration of March 8th", *Pei ching fu-nü* (Women of Peking), No. 5, 1950.4.1.

1950—See Busy season for 1957.

1952 (I)—Speech by Teng Ying-ch'ao at the 2nd All China Women's Congress "A basic summing up of the Chinese women's movement during the last four years and the tasks from now on," *HCKFN*, No. 5, 1953, p. 8 ff.

(II)—See above 1957 II.

Old liberated areas

1949 (I)—For the figures (50–70), "Review of women in agricultural production," *HCKFN*, No. 8, 1950, in *HHYP*, Vol. 1, No. 6, 1950.4.15., p. 1449.

(II)—See *new liberated areas* for 1949.

(III)—For the figures (50–80). Editorial, "Earnestly do a good job in women's work", *Cha-ha-erh jih-pao* (Chahar Daily), 1950.3.8., in *HHYP*, Vol. 1, 1950.4.15., p. 1447.

1950—*Women in New China*, Peking, 1950, Foreign Languages Press, pp. 16 and 37.

1952—See *new liberated areas* for 1952.

Explanation of data for 1929–33

"Average areas" 32–53.

In explanation of table 2 we already calculated an agricultural population of 400–475 million in China, in 1929–1933. Men of working age (15–59 years) constituted about 27% of the total population,[1] which would mean 108–128 million of the agricultural population. Of these 108–128 million (15–59 years) 35% and 58% were working full time and part time respectively in agriculture. Hence 93% of 108–128 million worked in agriculture, which would mean 100–119 million men. These 100–119 million men made up 60% of all persons working in agriculture, children made up 16% and women 24%.[2] Hence of a total of 167–198 million people working in agriculture children made up 24–33 million and women 35–49 million. In table 2 above, estimate II, women of working age (15–59) made up 92–109 million of the agricultural population. Thus 32–53% of all women (aged 15–59) did some agricultural work, some part of the year (see table 3, above for 1929–1933).

Explanation of data for 1955

"Average areas".

In 1957, a Chinese language news item released by the New China News Agency reported that the number of 100 million women working in agriculture in 1956 was a fifth more than the number of women in agriculture in 1955.[3] On the basis of these two figures there were more than 80 million women working in agriculture in 1955. Comparing these 80-odd million to table 2, estimate II, would give us about 54–59% of the women doing some farm work in 1955.

Explanation of data for 1956

"Average" 67–79

An estimate of September 1956 mentioned more than 100 million women working in agriculture.[4]

From early 1957 four rough estimates exist of the number of women in farm work, two of 100,[5] and two of 110 million.[6] The figures were given in March on Women's Day. One source explicitly referred to 110 million women working during busy season in agriculture.[7] Comparing this to table 2, estimate II, would mean that roughly two-thirds–four-fifths of all women took part in farm work in 1956.

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[1] J. L. Buck, 1964, p. 376 and 377 calculated from table 12–14.

[2] Ibid. p. 372.

[3] "ACDWF issues propaganda points for the 3rd National Women's Congress", NCNA, 1957.8.29.

[4] Speech by Teng Ying-ch'ao, "The Party must strengthen leadership in women's work and unite and develop the forces of the masses of woman", *TKP*, Tientsin, 1956.9.25.

[5] (I) "Small statistics", *KJJP*, Peking, 1957.3.8.

(II) "Joint information on commemoration of March 8th, 1957, International Women's day from ACDWF etc., 7 organizations", *JMJP*, 1957.2.13.

[6] (I) Editorial, "Give full scope to women's socialist enthusiasm", *JMJP*, 1957.3.2.

(II) Speech by Hsü Kuang-ping, on a meeting in the capital on comemoration of March 8th, "Struggle to become an activist in socialist construction", *JMJP*, 1957.3.9.

(III) "Congratulations and best wishes", *WHP*, 1957.3.8.

[7] Ibid. see 3 III.

Explanation of data for 1957

"Average" 65–80

In mid-1957 113 million women were estimated to be engaged in farm work and handicrafts.[8]

Two articles in the *People's Daily* a few months earlier mentioned 1.5 million women in handicrafts[9] which would mean roughly 111 million women working in agriculture. One estimate from September 1957 referred to 120 million in agricultural production.[10] Comparing the 111–120 million to table 2, estimate II, would mean that about the same number of women were estimated to perform some farm work in 1957 as in 1956.

A glance at table 3 will first of all show that claims made in the early 1950's were exaggerated and did not materialize until after a massive campaign in 1956 to mobilize more women for farmwork was launched in connection with an intensive drive for collectivization.

Average areas

In "average areas" in 1950, already 60 percent of all able-bodied women of the agricultural population, it was claimed, were working in farming. In 1952, 60 to 80 percent of the women were said to do farmwork. This claim was published by the ACDWF, in English for Women's Day.

A year later the official organ of the ACDWF, *Hsin Chung-kuo fu-nü* estimated after the busy season in agriculture was over in September that 60 to 70 percent of the women worked in agriculture. Two national dailies, the *Kung-jen-jih pao* in late 1954 and the *Wen hui pao* in late 1955 again stated that 60 to 80 percent of the women were active in farming.

Simultaneously with the big push for collectivization in 1956, a massive campaign was launched to mobilize more women for the agricultural front. The leading national daily, in retrospect in March 1957, estimated that 60 to 80 percent of the women worked in agriculture in a great number of districts in 1956, and that earlier, in districts where women were not accustomed to farmwork, 40 to 50 percent of the women worked in agriculture. Hence, earlier claims appear exaggerated because first after a massive mobilization campaign, 60 to 80 percent of the women "in a great number of districts," it was claimed, were participating in agricultural production. (Sources, see table 3 "average areas").

Calculation of a possible range for "average areas" for 1955 of 54 to 59 percent (see above explanation of data for 1955) indicates that earlier data for "average areas" were most probably inflated.

For 1957, there is a calculation of 65 to 80 percent (see explanation of data for 1957) based on rough estimates already given earlier in 1956.

A news release from the official New China News Agency in 1959 claimed that in "busy season," 70 percent of all able-bodied women worked in agricultural production in 1957. (Source see table 3, "busy season" 1957). Thus, the rough estimates given for 1957 leading to an average of 65 to 80 percent appear to be exaggerated.

On Women's Day 1958, the leading national daily referred in a report from an All-China Women's Work Conference to an approximation of 90 percent of all able-bodied women working in agriculture. This claim was made before agricultural work really had started for the year. In 1959 and in 1960, the same percentage was reiterated by the official New China News Agency and the Ta Kung Pao in Peking, respectively. (Source see table 3, "average areas" 1958–60).

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[8] Speech June 1957 at the first conference for representatives of family members of workers and employees, Ts'ai Chang, Chairman, ACDWF, "Do a good job in household work and support the country's construction, *Chung-kuo fu-nü* (CKFN), (Women of China), No. 9, 1957, p. 2.

[9] See above note 2 II and 3 II.

[10] "The task of women of bourgeois class origin", *KMJP* 1957.9.9.

After the busy summer season was over, a report from one province, Shansi, in the *People's Daily*, listed 76 to 78 percent of the women active in farming. (Source see table 3, "busy season" for 1960.) If Shansi Province is representative with 76 to 78 percent of the women active in "busy season," then the figure of 90 percent for "average areas" must be far too high.

Model Areas

Turning to "model areas" in table 3, the official organ of the ACDWF, *Hsin Chung-kuo fu-nü*, in 1950 listed 80 percent of the women in "model areas" in agricultural work already in 1949. (Source see table 3, "model areas" 1949). The high participation rate of 80 percent specifically referred to localities where both women's work was well done and labor power was in short supply. That might imply that many able-bodied men were still away as soldiers.

The following year, 80 to 90 percent of the women were said to join farmwork. In directives issued by the ACDWF and published by the People's Daily in April 1950, a "model area" was mentioned where 80 percent of the women worked in agricutlure. (Source see table 3, "model areas" (80) for 1950).

A book from 1953 gave 90 percent for the period 1950–52 for "model areas." (Source see table 3, "average areas" (60) 1950.) *Hsin Chung-kuo fu-nü* in September 1953 and *Ta Kung Pao* in 1954 repeated the 80 to 90 percent range for "model areas" for 1953. (Source see table 3, "model areas" 1953.) The *People's Daily* in 1957 claimed that more than 90 percent of the able-bodied women in the preceding year had done some farmwork in "model areas," while a Women's Day article in the same paper on Women's Day in 1958 claimed to know of a "model area" where all women worked. (See table 3, "model areas" for 1956 and 1958.)

Busy Season

As "model areas" could be of any size and chosen in the most suitable way, it might be of interest to compare them with the participation rate for "busy season," though the estimates are computed in different ways. In "model areas" a range has been given for the proportion of women usually said to participate in agricultural production. "Busy season" just measured the peak involvement of the year.

In 1950, 80 percent of the women working, it was estimated, were working in "model areas," while up to 80 to 90 percent of the women in all of China were needed during the "busy season" in farming. (Source see table 3, "model area" 1949, and "busy season" 1949.) The interesting thing is that in 1951 and 1956 and even more so in 1958, a higher proportion of women working, it was claimed, were working in agriculture in "model areas" than the proportion of women working when there was a peak demand for women's labor during the most labor-intensive periods of the year, during the "busy season." (Sources see table 3, "model areas" 1951, 1956, 1958, and "busy season" 1951, 1957.)

Thus, either the "model areas" were less mechanized and therefore had to rely on more labor, which does not seem very likely, or they had managed to keep the population more intensively occupied throughout the year either in land improvement or developing more sideline production, which might seem more likely. In reports from "model areas," the development of subsidiary production was especially mentioned. (See table 3, "model areas" 1950, 1952, 1958). Hence, in our definition of agricultural work, category *(c)*, those engaged solely in subsidiary production might have increased more in "model areas" than in other districts. In this way more women could be engaged than would otherwise have been the case if only peak seasons requirements in agriculture were to be met. Thus, much of this increase might have fallen outside our definition of estimate I, but within the wider definition of estimate II.

The demands for women's labor participation either decreased over time during "busy season," or the early estimates were inflated because the estimates given show a decreasing proportion of women participating in fieldwork during "busy seasons." (Sources see table 3, "busy season.")

Backward, New and Old Liberated Areas

J. L. Buck estimated that about a third of all women did some farmwork in 1929–30, which corresponds to estimates given for "backward areas" for 1950, and for "new liberated areas" for 1949–52. The estimate of 32 to 53 percent calculated for "average areas" from J. L. Buck's data for 1929–33 (see explanation to data for 1929–33), corresponds to the range of 30 to 50 percent given for "new liberated areas" in 1949. That is, one-third to one-half of all able-bodied women took some part in agricultural work. For the years 1949 and 1950, what are called backward areas correspond to "new liberated areas." Still, the claims made for 1949 for both "backward," "new liberated areas," and "old liberated areas," were apparently set too high, as the participation rate decreased over the next 3 years.

In a Women's Day speech in 1950 Teng Ying-ch'ao, Vice-Chairman of the ACDWF, compared "old liberated areas" with 50 to 70 percent of all able-bodied women workers in farming to "new liberated areas" with only 30 to 50 percent of the women participating in 1949. Three years later Teng Ying-ch'ao in a speech to the Second All-China Women's Congress in May 1953, made the same comparison. On this occasion, however, fewer women were estimated working in agriculture, only 40 to 50 percent in "old" in contrast to 20 percent in "new liberated areas." If we are to believe the estimates the proportion of women participating decreased over time, both during "busy season," and in "new and old liberated areas."

Most likely the very first claims for all of them were inflated, they were for the "average areas" during the first period. According to official Chinese sources, "old liberated areas" were considered to be more advanced, because they had carried out land reform earlier. Therefore they were also officially claimed to have emancipated women earlier, (i.e., mobilized more women for agricultural production). Still by comparing different statement from Teng Ying-ch'ao, Vice-Chairman of the ACDWF, in 1952 and 1953 we can see that the reverse was the case. That is "old liberated areas" were estimated to have fewer women in agricultural production than there were on the average in China.

In "old liberated areas" 40 to 50 percent of the women in 1952 were listed as working in agriculture by Teng Ying-ch'ao in a speech to the All-China Women's Congress in 1953. (Source see table 3, "old liberated areas" 1952.)

Teng Ying-ch'ao at the same congress and on two more occasions also estimated that 60 percent of all women in 1952 worked in agriculture in "average areas" in China. (See ibid., and "average areas" (60) 1952.)

In a publication by the ACDWF from 1953, 60 to 80 percent of the women were said to work in agriculture in "average areas" in 1952. (See "average areas" (60–80) 1952.) Apparently in different types of agriculture traditions corresponding to varying requirements of women's labor mattered more than the timing of the land reform.

In view of the fact that in an underdeveloped country with faulty statistics like those of China in the 1950's a figure for a small local area usually is more accurate than aggregate data, the provincial data would more likely reflect the real situation than the total sum or an average given for the whole country, and particularly so during the earlier years. Therefore we might look with greater confidence on the provincial figures supplied, then on those for different Chinese regions and last in order of decreasing reliability on data relating to all of China.

In table 4 below Chinese data have been computed on the percentage of women estimated to be working in different Chinsee provinces or regions 1949–60. Most of the figures are from local Chinese newspapers and a few from national papers.

TABLE 4.—PROPORTION OF WOMEN WORKING IN AGRICULTURE OF ALL WOMEN OF WORKING AGE IN THE AGRICULTURAL POPULATION, BY PROVINCE OR REGION OF CHINA, 1949–60

[In percent]

Single province or region	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
North East China	60			80–90								
North China	80+											
Kirin		83						80				
Hopei								80				
Shantung						50−						
Shansi							50	70				76–78
Honan								90				
Kiangsu	40						65			80	95+	
Anhwei					43					95+		
Chekiang					30–40			60–70			90+	
Kiangsi								80				
Fukien								80	*63			
Hunan									*50±	*90+		
Kweichow												100−
Szechwan								70–80				
Yünnan									68	100	95	
Jehol						90+						
Sinkiang						70	80–90	80	80			

Note: (1) + means more than. (2) − means less than. (3) ± means about. (4) * means data explained in the text after the table.

For Explanations and Definitions, See Notes to Tables 2, 3

SOURCES

North East China

1949—*Hsin chung-kuo ti fu-nü ch'ien-chin* (New China's women are advancing) Liu Mien-chih, Peking, 1953, p. 15 ff.
1952—Ibid.

North China

1959(I)—*Women in New China*, Peking, 1950, Foreign Languages Press, pp. 16 and 37,
(II)—*Folkets Kina* (People's China), Stockholm, 1951, Arbetarkultur, p. 186.

Kirin

1950 (I)—"New China's women show great activity in the construction of the fatherland", *T'ien-chin jih-pao* (Tientsin Daily), 1951.3.5.,
(II)—"Women of all places, with strength take part in the state's construction", *HHYP*, 1951, March.
1956—Extract from a report by the 3rd Women's Delegate Assembly, "Women! Try to be activists in socialist construction", *Chi-lin jih-pao* (Kirin Daily), 1957.5.10.

Hopei

1956—"Women make up an enormous force in the construction of socialism", *Ho-pei jih-pao* (Hopei Daily), 1957.3.8.

Shantung

1954—"The masses of women actively take part in agricultural production. A great many women became backbones in the agricultural mutual help movement", *JMJP*, 1955.3.7.

Shansi

1955—P'u Hsing, Shansi Provincial Women's Federation, News team, "The great liberation of Shansi women has provided a decade of civil development and military preparedness", *Shan-hsi jih-pao* (Shansi Daily), 1959.9.23.
1956—Ibid.
1960—"The women of Shansi participate in the autumn field management", *JMJP*, 1960.8.19., p. 4. The figures refer only to Shansi province in the busy season.

Honan

1956—The Provincial Women's Federation calls a conference to discuss the problems of women having jobs. "Manage well household work, practise equal-work equal-pay. Let women join agricultural production enthusiastically and happily", *Ho-nan jih-pao* (Honan Daily), 1956.9.9.

Kiangsu

1949—Shih Chien, "Ten brilliant years in the Kiangsu women's movement", *Hsin-hua jih-pao* (New China Daily), Nanking, 1959.9.24.
1955—Ibid.
1958—Ibid.
1959—Ibid.

Anhwei

1953—"Women are a fresh army for socialist construction", *An-hui jih-pao* (Anhwei Daily), 1959.9.20.
1958—Ibid.

Chekiang

1953—Wen Yun, Chairman Chekiang Provincial Women's Federation, "Women . . . the liveliest reinforcement in the big leap forward", *Che-chiang jih-pao* (Chekiang Daily), 1959.9.22.
1956—Ibid.
1959—Ibid.

Kiangsi

1956—Yang Shang-k'uei, Secretary of the Kiangsi CP, "Fully develop the power of women and struggle to fulfill in advance the 1st 5-year plan", *Chiang-hsi jih-pao* (Kiangsi Daily), 1956.6.15.

Fukien

1956—"Important contributions at various posts", *Hsia-men jih-pao* (Amoy Daily), 1957.3.7.

1957—Editorial—"Wish all the village women to be heroines", *Fu-chien jih-pao* (Fukien Daily), 1958.3.25.

Hunan

1957—"Progress and make great use of developing women in socialist construction", *JMJP*, 1958.11.12.

1958—Ibid.

Kweichow

1960—"Extend the great utility of women in the high tide of production", *Kuei-chou jih-pao* (Kweichow Daily), 1960.4.25.

Szechwan

1956—Tai K'o-yu, Vice-Chairman, Szechwan Provincial Women's Federation "Hail the mighty achievements of the Szechwan women's movement", *Szu-ch'uan jih-pao* (Szechwan Daily), 1959.9.29.

Yünnan

1957—Fang Wen-chien, Vice-Chairman, Yünnan Provincial Women's Federation, "The Great Leap Forward of the women's movement", *Yün-nan jih-pao* (Yunnan Daily), 1959.10.12.

1958—Ibid.

1959—Ibid.

Jehol

Jehol was abolished as a province in 1955. The eastern section of Jehol and Liaoning province were amalgamated. The rest, the western part of Jehol was incorporated into the Inner Mongolia Autonomous Region. "The masses of women actively take part in agricultural production. A great many women became backbones in the agricultural mutual help movement", *JMJP*, 1955.3.7.

Sinkiang

1954—Ibid.

1955—Ma-li-ya, Sinkiang Women's Democratic Federation, Leader of propaganda department, "Sinkiang women in the big family of the motherland", *JMJP*, 1955.3.2.

1956: Wu Ch'ien-chang, Secretary of the CCP Committee of the Sinkiang Uighur Autonomous Region, speech at the 2nd Women's Representative Conference of the Sinkiang Uighur Autonomous Region, "Command all the women forces in the Autonomous Region to construct socialism", *Hsin-chiang jih-pao* (Sinkiang Daily), 1956.10.23.

1957—"Thousands and tens of thousands of women of all races take part in productive construction and make important contributions to the socialist construction cause of the autonomous district of Sinkiang", *Hsin-chiang jih-pao* (Sinkiang Daily), 1957.3.8.

Explanation of data from Hunan 1957 and 1958

According to statistics, Hunan province had a year-end population in 1957 of 36.2 million. The statistics in the article are from September 1958 therefore the round figure of 37 million is used.[1] In the article it is said that 10.15 million women working in production were 64 percent of the total number of the village women. Thus there is a total of 15.87 million village women which is 43 percent of the total population. Women aged 15–59 in the 1950's made up 27–29 percent of the total population (data derived from calculations in my forthcoming dissertation), which is roughly 10 million.

With 10 million women 15–59 years in the total population a maximum of 85 percent can be counted as rural, which means 8.5 million women 15–59 years of the agricultural population. Of the 10 million women who had joined production 8 million had joined agricultural production. Thus more than 90 percent of the women 15–59 of the agricultural population worked in agriculture. Thus, of all women in production here, 80 percent were in agriculture.

With 10 million women in production that more than doubled the number working in production in comparison to last year the same time (September 1957). Thus 5 million women worked in production in September 1957. Assuming that 80 percent of them worked in agriculture, as they did in 1958, there would have been 4 million women in agricultural production which is about 50 percent of all village women 15–59 years of the agricultural population in 1957 (of about 8 million one year earlier).

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[1] N.-R. Chen, 1965, p. 132.

Explanation of data for Fukien 1957

In the editorial (see source for Fukien 1957) it was estimated that of an agricultural labour force of 5.6 million in the whole of Fukien women made up 45 percent which would give 2.52 million women in farm work. In addition 1.5 million women did not take part in agricultural production, which would mean that 63 percent of the total number of able-bodied village women took part in production. The sentence before revealed that too few women worked too little in the fields. Thereafter a calculation was made of how the APC's would benefit if all the women available could take part in agriculture as the village women had done in the model APC, the Long March. Thus, the 1.5 million women referred to women with working capacity in the agricultural population and not to other population groups.

In table 4 the low data indicating that from 30 to 65 percent of women worked in Chinese agriculture up to 1956 were all published in late September 1959, in commemoration of the 10th anniversary of the founding of the PRC (see table 4, sources for Shansi 1959, Kiangsu 1949, 1955, Anhwei 1953, Chekiang 1953, 1956). The low figures were given in contrast to higher percentages achieved later, either in 1956 (see table 4, sources for Shansi 1956) or 1958 (see table 4, sources for Kiangsu 1958, Anhwei 1958) or 1959 (see table, 4, sources for Kiangsu 1959, Chekiang 1959).

The high data of 60 to 90 percent for the early 1950's were all published before 1954, and all referred to north and northeast China. Two sources gave 83 percent for Kirin province in 1950 (see Kirin 1950) while the rounded figure of 80 was given for Kirin 6 years later in 1956 (see Kirin 1956). Thus, either the number of women in agriculture decreased or stagnated, or the first figure for 1950 was inflated or both of them were. The two sources for Kirin for the year 1950 were published in connection with Woman's Day 1951, while the data for 1956 was published before the busy summer season in May 1957 exhorting women to work in the same great great numbers in agriculture as in the preceding year. (See table 4, sources for Kirin, 1950 and 1956.) Earlier it was indicated that "old liberated" areas did not have higher participation rates than the average claimed for all of China at the same time. North and Northeast China had only new liberated areas.

Therefore, it appears that tradition might play a more crucial role than the timing of the land reform. According to J. L. Buck's study from the 1930's the greater this number of busy seasons in agriture the more likely a higher participation rate of females, and more labor intensive a crop was, the more likely there was to be a higher proportion of women participating.[205] North China in comparison to the rest of China had fewer busy seasons in agriculture and less labor intensive crops, wheat in comparison to rice. Thus type of crop and climate will not explain the estimated high participation rate of women in agriculture. But another phenomenon, the degree of industrialization type of industries and how it in different ways will effect women and men might give an explanation. Statistics from the Soviet Union, Japan, and Europe, show that during industrialization women as a group were left longer in the most primitive and least productive areas of the economy.[206] In China this means agriculture. Later on when women were mobilized for industry they were first channeled into its most unproductive sector.[207] This was particularly true if fairly rapid industrialization took place and resources were concentrated in heavy industry.[208] This appears to have been the case with North and Northeast China.

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[205] J. L. Buck, 1964, p. 291, table 2.

This pattern of women being left in agriculture and men being recruited by heavy industry has even been promoted as a national model, the Ta-ch'ing model. In Ta-ch'ing men as a group were recruited to work in the oilfields, together with a minority of young women, while the majority of women were mobilized for agricultural production.[209]

North and Northeast China have exceptionally high percents for the early 1950's published before 1954. Besides that there are only high data from Northwest China (that is, Jehol and Sinkiang) for the years before 1956. The 1954 and 1955 data were both published by the *People's Daily* in connection with Women's Day 1955. Hence the percentage given on March 2 for 1955 as the women's participation rate that year in Sinkiang can hardly refer to agricultural production, but appears to be rough estimate. Women were said "for the time being to take part in agriculture allsidedly particularly in weeding and cotton planting." Could that really refer to weeding and cotton planting in 1955? The rate of 70 percent was given for the preceding year, also in the *People's Daily* 5 days later.

All the pre-1956 ranges given for the fertile areas of China where agriculture is more important in the economy than in Northeast or Northwest China give percentages from 30 to 65. These percentages include the provinces of Shantung, Shansi, Kiangsu, Anhwei, and Chekiang. Our calculation for 1955 from table 3 (see table 3, "average areas" and explanation of data for 1955) of 54 to 59 percent corresponds quite well to the ranges for 1955 in table 4 of 50 to 65 percent. Also the 30 to 43 percent given for 1953 compares well with the contrasting data given for new and old liberated areas referring to the preceding year (see table 3 for 1952 old and new liberated areas). In the same vein the 40 percent for Kiangsu in 1949 (table 4) corresponds to the 30 to 50 range for "new liberated areas" for 1949 (see table 3).

In table 4 the year 1956 has the highest number of estimates for any one year. All the high data for that year of 80 percent and 90 percent were either published in 1956, or in connection with Women's Day, March 1957. Thus the highest estimate for 1956 of 90 percent is from September 1956, while one figure of 80 percent is from June the same year and three more of 80 percent are from Women's Day

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[206] N. T. Dodge, *Women in the Soviet Economy*, 1966, p. 162 ff. Tabashi Royama, *The Changing Social Position of Women in Japan*, UNESCO, 1961.

E. Boserup, *Kyinna i u-land* (Women's role in economic development) 1970, part II, p. 53, 184 ff.

[207] "Hold high the banner of Mao Tse tung thought, further mobilize women to realize the struggle for a continuing Leap Forward in 1960." Excerpts from a speech by Ts'ai Ch'ang, Chairwoman ACWT, on its second meeting 3rd executive committee. *JMJP*, 1960.2.25.

Referring to modernized big enterprises "where the greater part of the workers in the hand-operation departments are women".

[208] (I) "Speech by comrade T'an Chen-lin at the National Conference of Women Activists in Socialist Construction", *CKFN*, No. 1, 1959.1.1., p. 6 ff.

(II) Ma Wen-jui, "The problem of labor force in building socialism in our country", *Hung-ch'i* (Red Flag), No. 5, 1961.3.1.

(III) Li Ting-ching, "On the problem of labor distribution in industry and agriculture" in *KMJP*, 1961.11.20. in CCD No. 60, p. 59 ff.

[209] (I) Reporter from CKFN, "The revolutionary family dependents in Tach'ing," *CKFN*, 1965.5.1., No. 5.

(II) "Recent reports from Tach'ing oilfield," URS, vol. 70, No. 8, p. 108, 1973.1.26.

(III) "Actively bring up and develop women cadres from among the dependents of workers and staff," *JMJP*, 1973.3.10.

1957. The lowest estimates for 1956 of 60 to 70, 70 and 70 to 80 were all published in 1959 in connection with the 10th anniversary of the founding of the PRC. In two of the three cases lower ranges before 1956 and higher ranges after, are given (see table 3 for 1956).

Likewise for the year 1957 three low data of 50 to 68 percent were all published in 1958, while the only high figure for 1957 that from Sinkiang of 80 was published in March of 1957 (see table 3, see Hunan, Yunnan, and Sinkiang). In addition there is an estimate from the Shanghai rural areas (not included in table 4) saying that 65 percent of the women participated in agricultural production in 1957, in contrast to 95 percent in 1958.[210]

In the same vein the lowest figure for 1958 of 80 percent was published first in September 1959 and had an even higher percentage of 95 plus for 1959 (see Kiangsu 1958, and 1959). The highest figure of 100 percent for 1958 decreased to 95 in 1959, but was as low as 68 percent for 1957. This figure (see Yunnan 1957–59) and the one for Anhwei of 95 plus were both published in commemoration of the 10th anniversary of the People's Republic of China in September 1959. For the year 1959 there is one figure of 90 plus, two of 95 plus, all published at the time of the anniversary, all of them starting from lower percentages for earlier years, from 40 in 1949, or 30 to 40 in 1953 or 68 in 1957. For the year 1960 there are two estimates, one of "almost 100 percent" given in April in Kweichow, thus during their first busy season of the year, though it does not refer specifically to any busy season. The other estimate from Shansi, published in mid-August 1960 in the *People's Daily* explicitly referred to 76 to 78 percent of women working during the busy season in agriculture. Another source, the *Shansi jih-pao*, at the time of the 10th anniversary in the preceding year, 1959, stated that 70 percent of the women worked in agriculture in 1956 which would be consistent with the 1960 data of 76 to 78 percent. Thus in both table 3 and 4 a few general tendencies in the data can be discerned. Figures given at the time of the publication are as rule much higher than figures given for the same period published a few years later.

Most of the data for the early 1950's appear ill-founded or exaggerated as the same data reoccur after a number of years with mobilization campaigns in between when more and more women, it was claimed, joined agricultural production (see table 3, "average areas" 1952–56), (see table 4, Kirin 1950 and 1956). The first data given are set so high that a decrease is shown over time, though all media claim that the number of working women is continually increasing (see table 3, "backward areas," "busy season," "new liberated areas," and "old liberated areas").

In comparing table 3 and 4 a pattern emerges. Beginning with Buck's data for 1929–33 of 30 plus or our calculation of his data leading to 30 to 50 percent, the same range was given for "old liberated areas" up to 1953 (see table 3, "old liberated areas" 1952) and the range 30 to 50 percent from 1949 to 1955 for five different provinces (see table 4). For 1955 there is a calculation 54 to 59 percent (see table 3, "average areas" 1955) and data from two provinces of 50 and 65 that were published first in 1959. For 1956 there is a calculation of

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[210] Shanghai Municipal Women's Representative Congress decides on a great scale for the "5-good movement," "To use the enormous force of women in the Great Leap Forward," *KMJP*, 1958.2.17.

67 to 79 percent (see table 3, "average areas" 1956). Excluding all data published that year or for Women's Day 1957 the data published in 1959 give 60, 60 to 70, and 70 to 80 percent, which would be in line with our estimate for 1956. For 1957, if Women's Day data published that year are excluded (see table 4, Sinkiang 1957) all figures give the range of 50 to 68 (see table 4 1957). That would fit well in with a busy season figure of 70 percent for 1957 (see table 3, "busy season" 1957), while our estimate of 65 to 80 percent for 1957 based on high 1956 data appears to be on the high side.

After the formation of the people's communes in late 1958 a new campaign to mobilize women began, as in 1956. This campaign will partly explain the high data for 1958 of 80 to 95, which continued well into 1959. Another part of the explanation is that the formation of the rural people's communes in late 1958 meant a complete transformation and collectivization of life. Hence, for example, women who cooked on a private basis earlier would have had to perform the same activities in a communal setting after the formation of communes, and would thus have been included in the agricultural labour force, category c. By cooking in public canteens instead of in their own kitchens they would release some more women for work in the fields. Both the women in the canteen and the women they released from cooking would be included in the agricultural labour force. In this way part of the high increase in the proportion of women working in agriculture may be explained.

The poor harvest in 1959 contributed to the closing of many of the canteens, nurseries, and collective service undertakings in 1959 and 1960, leading to a lower labor force participation rate for women. As the great crisis in agriculture was well underway in 1960, and the statistical system had already broken down in late 1958, national data might be regarded as even more suspect than provincial data for 1960. Thus the average of 90 for all of China appear dubious (see table 3, average 1960), while 76 to 78 for Shansi in busy season might be more reliable. This is also the case when comparing the Shansi figure with the estimate of "almost 100" for Kweichow, because the Shansi data are consistent with a 1956 estimate of 70 that was first published in late 1959. Earlier it was shown that estimates published a few years after the time period they refer to tend to be less exaggerated, therefore the Shansi data can be considered more reliable here (see table 4, Shansi, 1956 and 1960, and Kweichow 1960). The Kweichow and Shansi data can also be interpreted in another way; namely, that the Shansi figure conforms to our definition of estimate I while the Kweichow figure refers to estimate II of the agricultural labor force.

In this way a few data can be established for the number of women working in Chinese agriculture up to 1960. For 1929–33 there is a range of 30 to 50, which can be extended to 1954, then a range of 40 to 55 in 1955, 60 to 75 in 1956, of 50 to 65 in 1957, of 80 to 95 in 1958 and 1959, and of 70 to 80 in 1960.

The 1960's in China were characterized by a statistical blackout. Because no new national statistics has been published from 1960 onward there are only estimates for the post-1960 period. In regard to agriculture either data given earlier were repeated or very general statements were made. The only detailed information released usually referred to the local level, often to a commune or a production brigade. They were often depicted as models to emulate. Thus the accomplishments described would most likely represent the maximum achievement in that particular field.

In table 3 when comparing "average" with "model" areas over the years, the average difference given between model and average areas is 20–30 percent, if only the sources where both types of areas are estimated at the same time are employed. In both average and model areas for 1950–52 the difference of 30 in all three cases is given by the same source (see table 3, average areas, 1950 (60)). For 1952 Teng Ying-ch'ao twice and Wang Keng-chin once gave the difference of 30, and Teng Ying-ch'ao once of 20. In the same vein the difference of 20 to 30 was given for 1953 and 10 to 30 for 1956 (see table 3). In table 5 [below] a few scattered figures from the 1960's and 1970's have been computed.

TABLE 5.—PROPORTION OF WOMEN WORKING IN AGRICULTURE OF ALL WOMEN OF WORKING AGE IN THE AGRICULTURAL POPULATION, 1963–76

Year	Coverage	Percent women
1963	Some districts in Shantung	81.
1965	1 brigade, Hunan	36.
1965	1 commune	60.
1966	do	More than 80.
1970	1 brigade, Hunan	90.
1974	"In certain areas of China"	Less than 95.
1976	Ninghsia Hui Aut. region	"All".
1976	All China	"An absolute majority."

SOURCES

1963—"New times. new women, new styles", JMJP, 1964,3.9., p. 2.

1965—(I) "36." Chingsu Brigade Women's Congress under Hsinchuan commune in Hsiang yin County, Hunan Province "Get out from yours small family, be an equal to men", KMJP, 1970.4.1., p. 4 in URS, vol. 59, No. 9, p. 126, 1970.5.1. (II) "60." "Excellent policy, use Mao Tse-tung's though to arm the women," JMJP, 1966.3.4.

1966—Ibid.

1970—See 1965, I.

1974—"Women of China today," NCNA, 1975.3.5.

1976—"all," "Social status of Hui women in North West China," NCNA, 1976.3.4. "an absolute majority," "Women prop up half the sky," NCNA, 1976.3.7.

Assuming the same difference being employed between model and average areas for the 1960's and 1970's as for the 1950's, means a deduction of 20 to 30 percent from the average of about 80 given, would mean 50 to 60 percent. The 1965 figure of 36 and 60 explicitly referred to conditions before a change was introduced [see table 5, source for 1965]. The continued exhortations in the press during the 1960's about the need for more labor and particularly more women to join agricultural production clearly showed that the high rates claimed for women during 1959 and 1960 were not sustained.[211] If that had been the case, there would hardly have been any more women left to draw into farm work, and thus no need to propagate for it. The continued stress over the years showed that the demands apparently were not met. A few sources indicate that in some places women, before the start of the cultural revolution in 1966, seldom took part in agricultural production:[212]

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[211] (I) Editorial, "Women, Contribute More to the Effort to Win a Bumper Harvest of Crops This Year," JMJP, 1961.3.8.

(II) "Agricultures labor requirements will be great for long time", KMJP, 1961.9.25. in CCD, No. 58, p. 67 ff.

(III) Editorial, "Women Strive for New Victories," JMJP, 1963.3.8.

(IV) "We Absolutely Need More Agricultural Laborers", KMJP, 1963.10.7. in CCD, No. 118, p. 90 ff.

(V) "Announcement From the National Women's Federation to All Levels of the Women's Federation About Commemoration of 1965.3.8., International Women's Day", CKFN, 1965.2.16., p. 1 ff.

(VI) Editorial, "Fully Arouse Rural Women to Take Part In Collective Labor," Pei-ching jih-pao (Peking Daily), 1965.10.11. in SCMP. Suppl., No. 148 1966.3.1., p. 30.

> The masses of women in Hou-chai Commune had seldom taken part in political activities and collective productive labor before the great cultural revolution under the evil influence of the renegade hidden traitor and scab Liu Shao-ch'i's counterrevolutionary revisionist line of the women's movement.[212 II]

Obviously women's labor force participation rate declined markedly during the early 1960's to levels prevailing before 1958. Only two types of special areas showed high labor force participation rates for women: coastal villages where men were preoccupied with fishing[213] and some districts specializing in cotton production where women traditionally worked as cotton pickers.[214]

The policy of assigning the highest priority to agriculture from 1961 and the development of small- and medium-sized industry linked to agricultural drew some male labor power from agriculture and increased over time the need for female labor power. Apparently not enough women participated in production because in the Women's Day celebrations in 1972 a Mao quotation was used exhorting more women to work:

> China's women are a vast reserve of labor power. This reserve should be tapped in the struggle to build a great socialist country.[215]

A women's labor force participation rate of 50 to 60 percent for the early 1960's can be assumed. With emerging rural industrialization this rate increased to 60 to 70 percent in the mid-1960's, and in 1974 reached 70 percent. The estimate of 70 percent is based on the two 1976 claims [table 5], and then a subtraction of 20 to 30 percent [see earlier in the text]. In this way the ranges estimated earlier can be employed for 1929–33, 1949–60 to reach an approximation of the number of women engaged in agriculture. In calculating the approximate number of women in millions ranges established in table 2, estimate II have been employed.

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[212] (I) "The status of Women in China", Heilungkiang Radio, 1968.3.6. in China Notes, No. 256, 1968.3.21., p. 1.

(II) "Bring Into Play Women's Role in the Three Great Revolutionary Movements", Chekiang PRS, 1971.3.8., 6:30 p.m. in URS, vol. 62, No. 25, p. 341 ff., 1971.3.26.

(III) "How To Carry Through Equal Pay for Equal Work for Men and Women," Hung-ch'i (Red Flag), No. 3, 1972.3.1., p. 89 ff. See table 5 (above) source for 1965. I.

(IV) "Communes in Min Ching County Correct Wrong Views on Women," Fukien PRS, 1971.3.11 7 30 p.m. in URS, vol. 62, No. 23, 1971.3.19. p. 309.

[213] (I) Report on all investigation in Kiangsu, Ch'itung county Lütsu commune, production brigade 10, "Bring into fuller play the role of women as a labor force", Hung ch'i [Red Flag], No. 3, 1973.3.3., p. 43 ff.

(II) "Women on East China Islands," NCNA, 1973.3.31.

[214] (I) "Women Prop Up Half the Heavens," NCNA, 1973.9.9.

(II) "Women's Cotton Growing Teams in North China," NCNA, 1974.4.29.

(III) Li Chen "Women Take Part In Productive Labor," Peking Review, No. 12, 1974.3.22., p. 17.

[215] "Round-up of Provincial-level Women's Day Activities, "Huhehot Inner Mongolia RS in Mandarin 11 GMT, 1972.3.9., in Daily Report, FBIS-CHI-72-52, p. B 3, 1972.3.15.

TABLE 6.—*Estimated total number of women of working age working in Chinese agriculture, 1929–33 and 1949–78*

[All estimates have been adjusted and rounded to the nearest 5 million.]

	Millions
1929–33	30–55
1949–52	40–70
1953–54	40–75
1955	45–80
1956	85–115
1957	70–100
1958–59	110–145
1960	95–120
1961–64	70–95
1965	75–100
1966	90–115
1967	90–120
1968–69	95–125
1970	100–130
1971–72	100–135
1973	105–140
1974–75	125–145
1976	130–150
1977	135–150
1978	135–155

After comparing the proportion of women in farmwork to all women, aged 15 to 59, of the agricultural population, the proportion of women working in agriculture is compared to the proportion of men. In table 7 below J. L. Buck's data from the 1930's have been compared with data from a limited Chinese survey of 228 APC's made in 1957.

In table 7 women working in agriculture were not compared to the proportion of all women in tables 3 and 4, but to the male population, for 1957, and to children as well for 1929–33. As regards the

TABLE 7.—PROPORTION OF WOMEN AND MEN WORKING IN CHINESE AGRICULTURE IN NORTH, NORTHEAST, AND SOUTH CHINA IN 1929–33 AND 1957

[In percent]

Year/region	1929–33 estimate		1957
	I	II	
South China:			
Women	21–33	29–42	46
Men	55–67	43–57	54
North China and Northeast China:			
Women	16–23	20–27	35
Men	66–75	60–68	65

Note: For definition of estimates I and II, see table 2.

Sources: J. L. Buck, 1964, p. 291, table 14, for 1929–33. For 1957, "Income and distribution in APC's in 1957." Tung-chi yen-chiu (Statistical Research). 1958.8.23. in U.R.S., vol. 13, No. 1, 1958.10.3.

Calculation for table 7 for 1929–33. For North China the data from the 3 wheat region areas have been employed. For South China the data from the Szechwan rice, the double cropping rice, and the Southwestern Rice region areas have been employed. For estimate I the data for those in "farmwork only" and "farm and subsidiary work" have been employed. For estimate II "subsidiary work only" has as well been included. Then the average for the 3 different areas has been calculated separately and then the range given for each of the 2 regions. The residual is made up of children.

proportions of women and men in Chinese agriculture, more women in South China than in the North worked in agriculture in relation to men, both in 1929–33 and in 1957. The proportion of men in agriculture for both regions shows no marked change over time, the percentages given for 1957 fall just below estimate I and within estimate II for 1929–33.

When category (c) of subsidiary production alone is included, as in estimate II, the proportion of women increases in relation to men. In addition, women in the South showed a greater increase than women in the North—comparison of estimate I and II.

From 1929–33 to 1957, women in the North showed a higher increase in their labor force participation rate compared to men, than women in the South did. This might be attributed to a pattern mentioned earlier where men were drawn into industry, particularly heavy industry, and because of that more women were required in agriculture. This type of development was most pronounced in North and Northeast China.

If the proportion of men working agriculture did not change over time, while the proportion of women increased, the change for women must therefore be attributed to a decrease in the proportion of children working in agriculture. The question is, how much of this change is fictional, attributed to changes in measurement and how much is real? Was education so universal in 1957 that schools retained such a high proportion of children that a corresponding rise in the proportion of women was needed for collectivization and more intensive farming?

The construction of dams and irrigation projects all over China in the winter and spring of 1959–60 engaged men to such an extent that 60 to 80 percent of those left to work in agriculture were women.[216] When the projects were completed men returned to agriculture lowering the proportion of women in the agricultural labor force. According to an estimate made in 1961, on the average in 1960 women made up 45 percent of all persons engaged in farmwork.[217] In table 8 below the estimates available have been computed on the proportion of women in relation to men working in agriculture, assuming that the proportion of children was negligible.

TABLE 8.—WOMEN WORKING IN AGRICULTURE AS A PROPORTION OF THE AGRICULTURAL LABOR FORCE, 1960–73

Year	Coverage	Locality	Percent women
1960	278 RPC's	All China	45
1962	1 brigade	Kwangtung	70
1966	In many production brigades		30–40
1971	1 brigade	Fukien	40
1972	do	Hopei	42
1973	1 commune	do	50±

SOURCES

1960—"Congratulate our women on their merits in doing agricultural work and produce more corps on a large scale," TKP, Peking, 1961.3.8.

1962—Kwangtung Provincial Women's Federation, "Women in Kwangtung make important contributions to socialist construction," Nan-fang jih-pao, Southern Daily, 1962.3.

1966—"Women of new China," NCNA, 1966.3.6.

1971—"Communes in Shao-wu County implement the principle of "equal pay equal work between men and women," Fukien PRS, URS, vol. 62, 1971.3.19, No. 23, p. 304.

1972—Investigation report from Hopei, Hsüan hua district, Ch'en chia fang brigade, "How to carry through for men and women equal pay for equal work," Hung ch'i (Red Flag), No. 3, 1972.3.1, p. 89 ff.

1973—"Women make up half of heaven," NCNA, 1973.9.9.

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[216] (I) "The whole nation's women workers are 8 million", WHP, HK, 1961.3.9. (II) "The use of China's women has increased even more in the construction of the country's industry and agriculture", Chung-kuo hsin-wen (China News Service), 1961.3.7.

[217] See under table 7, source for 1960.

In table 8 the estimates for 1960 and 1966 have the widest coverage, NCNA, indicating that women in 1960 and 1966 made up 45 and 30 to 40 percent respectively of all persons working in agriculture. That is very much in line with the 1957 data of 35 and 46 percent women of all working in the North and South of China, respectively (see table 7, sources for 1957).

Scattered figures from a few small units are somewhat higher, the highest from South China, Kwangtung 1962. The 1973 estimate from Hopei refers to an area specialized in cotton growing which traditionally engaged a high proportion of women. A correspondence between the 1957 and the 1960–73 estimates, can be seen just as there was earlier a similarity in participation rates for the early 1960's (see text after table 5), and the years before 1958 (see table 3 and 4) when comparing women in farm work to all able-bodied women of the agricultural population.

Thus, during the early 1950's women's work in agriculture did not substantially rise above the 1930 level until collectivization was completed in 1956. This institutional change considerably heightened female involvement for a year, which declined in 1957 though not to the pre-1956 level. The formation of the rural people's communes in 1958 and a change in the measurement system and rural reorganization drew most women into agriculture and kept them there during the crisis years of 1959 and 1960 when men had to work on dam-building and irrigation projects. During the early 1960's women's participation in agricultural production returned to pre-1958 levels, though over time to a somewhat higher level than that of 1957. When men in increasing numbers were drafted for farm land capital construction projects and later began to leave agriculture for the development of rural industries, more women had to be mobilized for agriculture, which explains the somewhat increased participation rate of women from the midsixties later.

WORKDAYS OF WOMEN IN AGRICULTURE

Not only were more women needed in agriculture but also more workdays per year were demanded of each participating woman. In Northeast China in 1951 a special drive had been launched to get more women into agriculture thus enabling men to transfer to industry and mining.[217] "Hundreds of thousands of women" were organized to release "100,000" male peasants from agricultural activities.[218] Thus the working time of each woman was counted as equivalent from one-half to one-tenth of that of a male peasant, probably indicating a much smaller number of workdays per year put in by women than by men.

An editorial in the leading party organ, the *People's Daily*, discussed measures to bring more women into production, especially in the production cooperatives in 1954.[219] An article a few days later in the same paper gave an outline of a timetable for women's work n the countryside. Annually a woman should work:[220]

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[217] "The women's movement in New China," speech by Teng Ying-ch'ao, October 1951, published by the ACDWF in English in 1952.

[218] Ibid.

[219] Editorial, JMJP, 1954.1.29.

(1) Half the year in agriculture,
(2) Two months in spinning,
(3) Two months for mending and odd jobs,
(4) One-half months in shoe-making, and
(5) A fortnight of weaving.

A village was given as a model where women performed one-third of all work done outside.[221] A proposal by the Vice Chairman Chang Yün of the ACDWF told women to devote one-fifth to one-third of the workdays in a year to work in agricultural production for the collective.[222] In the districts of Kiangsi —Province women on the average had 70 working days a year in agriculture in 1955.[223] In Szechwan Province in the plain areas in the same year women in APC's put in 68 working days, while in the mountainous areas women contributed well over 110 working days.[224] An editorial in the *People's Daily* on Women's Day 1956 specified that of 200 million village women, about 120 million in the APC's were in the labor force occupied with agriculture, livestock breeding, and sideline production.[225] Therefore women's labor power was not being put to full use, and could be further utilized.

This estimate reveals high demands for women to participate in agricultural work. According to table 2 there were 139 million to 150 million women aged 15 to 59 in the agricultural population in 1956. China's total population was estimated to be 626 million to 633 million in 1956 (see table 1b). In 1956 80.5 to 83.4 percent of the population was classified as agricultural according to the Chinese Communist definition of the term (see after table 2, calculation for the years 1949–60, and definitions of "agricultural"). Of an agricultural population of 504 million to 528 million in 1956 children under 7 years of age made up 22 to 24 percent of the population. Subtracting 111 million to 127 million children leaves 393 million to 401 million people over 7 years of age of which women made up slightly less than half. Hence in the requirement above all women over 7 years of age were considered eligible to be mobilized for agricultural production.

In connection with the adoption of the draft of the national program for agriculture, a target set for women's participation:[226]

> Women should strive hard to work at least 120 days a year in the coming 7 years. Those who have reached this standard should try hard to work more than that.[227]

Men were told to contribute 250 days a year.

The number of women working in agriculture increased sharply in 1956 in connection with the collectivization drive (see preceding chapter). The pressure to mobilize women for farm work relaxed considerably in 1957. Reports of misuse of women's labor gained momentum in 1956 (see chapter of women and overwork in agriculture).

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[320] JMJP, 1954.2.

[221] Ibid.

[222] Chang Yün, Vice Chairman, ACDWF, "Constructively direct village women to take part in agricultural mutual aid cooperative movement," CKFN, No. 3, 1954.

[223] A speech by the chairman of the Kiangsu Democratic Women's Federation, Yang Tsu-hsing, "Actively mobilize women to join agricultural production," Hsin-hua jih-pao (New China Daily), Nanking, 1956.126

[224] "Working days of rural Szechwan women will in 3 years surpass the target set for the seventh year of the National Program for Agriculture," NCNA-English, 1956.3.9.

[225] "Women of the whole country realize "The draft for the whole country's agricultural development from 1956 to 1957", JMJP, 1956.3.9.

[226] Ibid.

[227] Ibid.

When the pressure decreased in 1957 not only were fewer women working in agriculture but less was demanded of each woman. Therefore, a much greater flexibility was found in the 1957 version of the national program for agriculture where women were required to accomplish 80 to 180 days a year of productive work.[228]

In suburban areas in order to release more men for industrial work women cooperative members were told to strive to constitute 90 percent of the labor power in APC's within 2 years.[229] Suburban APC's specializing in production for urban areas in growing more vegetables, some of it in hothouses, and breeding fish and poultry demanded more labor days put in per year than rural APC's. This demand weighed heavily on women, not only because of more labor intensive crops but also because the men were to be released for industrial work.

Earlier it was mentioned that women as a group were left in the most primitive and unproductive sectors of the economy during the period of industrialization. This pattern was intensified here because of the greater opportunities for men to leave agriculture for more productive work in urban areas than in rural APC's. For this reason it can be expected that the proportion of women of all persons working in agriculture and also the number of work days demanded of them will be higher in suburban than in rural areas. In connection with the long-term agricultural planning in Shensi Province the Provincial Women's Federation drew up a plan for women's work. For a start women were to work not less than 120 days a year in agriculture. In 7 years time they would be expected to be working at least 180 days annually. Finally in 12 years time they would be working not less than 200 work days a year.[230] In Kwangsi Province women were told to work 250 man-days a year in agriculture in APC's.[231]

In Honan Province in 1956 about 10 percent of the village women did not take part in field work. At a conference August 29 to September 4, 1956, discussing problems of rural women and outside work arranged by the Honan Women's Federation the results of an investigation were disclosed showing that 50 to 60 percent of the village women in the economic crops districts worked 120 days, in grain-producing areas 100 days, in mountain areas not less than 100 days.[232] A provincial plan was mapped out for 1957 asking that each woman work 150 days, and in cotton and tobacco-producing areas not less than 200 days. In some districts women had even been told to put in 300 work days.[233]

In the article it was said that the investigation was carried out in the year 1957, apparently given in error as the article was dated September 1956. This was the time when the draft of "the National Program for

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[228] "Communist China 1955–59, Policy Documents with Analysis," Harvard University Press, 1962, p. 119.

[229] Excerpt from the speech of the Chairman of the Municipal Women's Federation in Shenyang, "Shoulder the task of socialist construction," Shen-yang jih-pao (Shenyang Daily), 1956.4.13, Hou Chih, on the Second Women's Congress.

[230] Shensi Provincial Democratic Women's Federation "Determine a long-term plan for the work for women of the whole province." Shen-si jih-pao (Shensi Daily), 1956.4.15.

[231] Speech to the 2d plenary session of the 1st Kwangsi Provincial Committee of the Chinese People's Political Consultative Conference, "Women's role in construction in Kwangsi." Kuang-hsi jih-pao (Kwangsi Daily), 1956.4.28.

[232] The Provincial Women's Federation calls a conference to discuss the problems of women having jobs. "Manage well household work, practice equal work, equal pay. Let women join agricultural production enthusiatically and happily," Ho-nan jih-pao (Honan Daily), 1956.9.9.

[233] Ibid.

Agriculture 1956–67" was discussed and in that connection in this article a provincial plan was put forward by the Women's Federation to increase women's work participation rate during the same period.

According to a report by the Honan Statistical Bureau in 1958 a survey of 31 hsien and municipalities and 1,951 APC's revealed that the female labor force worked on an average of 126 days in 1957.[234]

Examples were given both of how cooperativization in agriculture increased the number of work days performed by women, and of excessive demands on women's work participation. A survey published in English reported on one county in Hopei Province where the average able-bodied women worked 30 days and able-bodied men 110 to 120 days annually before cooperativization. After it, women in the lower APC's accomplished 70 to 80 days and men 170 to 180 days. Finally in the higher APC's women performed 230 days of work and men put in 270 days.[235]

These claims are in contrast to examples given earlier in an editorial in Chinese in the leading national daily of the difficulties encountered in raising the number of work-days for women in the APC's:

> In Kiangsu Province, Tung Shan county, the Sha Kuang agricultural cooperative decided that full-time able-bodied female laborers should have 270 working days a year, while half-time able-bodied female laborers should have 131 days. But in reality able-bodied women working full-time worked only 170 days while those on half-time put in 60 days. So the requirements were clearly too high.[236]

In analogy with table 7 (see above preceding section) a higher proportion of men than of women worked in agriculture and a greater proportion of the men could be labeled full-time laborers. According to one investigation of 228 APC's in 1957 women on the average worked 105 days that year while men put in 204 days.[237] Of all those working in the APC's the smallest group of men were among those who worked least, less than 50 days in 1957, while exactly the reverse situation prevailed among the women. Their smallest group was among those who worked most, more than 201 days in 1957. Almost two-thirds of the male labor power worked more than half the year as compared with one-fifth of the female labor force (see table 9 below).

TABLE 9.—NUMBER OF WORKDAYS PERFORMED BY WOMEN AND MEN IN 228 APC's IN 1957

	In percent				
	Less than 50	50 to 100	101 to 150	151 to 200	201 plus
Women	32.5	29.7	19.0	10.9	8.2
Men	6.5	11.9	18.3	24.0	39.3

Source: "Income and distribution of APC's in 1957," T'ung-chi Yen-chiu (Statistical Research), 1958.8.23, in URS, vol. 13, No. 1, 1958.10.3.

Regional differences, mentioned several times earlier, still persisted with more women working in the South. The difference in the number of workdays was more pronounced among women than among men [see table 10 below].

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[234] Report by the Honan Statistical Bureau, "Women are a strong force in socalist construction," Ho-nan jih-pao (Honan Daily) 1958.3.8., in Weekly Report, Sum 1916, p. 12.
[235] "Ending rural unemployment." by Cheng Lin-kuan and Lin Tsung-ho. "People's China", 1956.12.16.
[236] Editorial, "Protect the health of rural women and children," JMJP, 1956.5.16.
[237] See source for table 9.

TABLE 10.—PROPORTION OF WORKDAYS IN PRODUCTION PERFORMED BY WOMEN AND MEN IN THE MAIN GEOGRAPHICAL AREAS OF CHINA IN 1957

Areas	Percent of total labor power		Average number of workdays each laborer worked during 1957		Percent of total number of workdays	
	Female	Male	Female	Male	Female	Male
Northwest and Inner Mongolia	39.9	60.1	80	170	25.5	75.5
Northeast region	34.7	65.3	60	185	14.5	85.5
Central region	44.2	55.8	84	195	25.4	74.6
Southern region	45.7	54.3	133	222	33.2	66.8

Source: See under table 9.

The Northeast region required the least workdays in agriculture while the Southern region demanded the most. The difference was also greatest between women's and men's labor input between these two regions. Women only put in one-third of men's labor in the Northeast region in comparison to almost two-thirds in the Southern region. Hence both women made up a higher proportion of the labor power and their labor input was higher in the South than in the North of China. In Northwest and Northeast China women made up a smaller proportion of the labor force and performed less workdays during 1957 than in any of the other areas in China. A positive correlation is thus established between proportion of women working and the amount of time they work in agriculture. More women work in the South than in the North and they also devote more time to agricultural work. This refutes the claims made for an exceptionally high rate of women's participation for the period 1949–52 for Northeast China (see table 4). In table 11 (below) a compilation has been made over workdays per year performed by women and men of the agricultural population.

TABLE 11.—WORKDAYS PER YEAR BY WOMEN AND MEN OF WORKING AGE OF THE AGRICULTURAL POPULATION, 1954–72

[In parenthesis for men]

Geographical area: Coverage	1954	1955	1956	1957	1958	1959	1961	1962	1967	1972
All China:										
1957	[1] 150			[1] 80-180	([2])					
228 APC's 105 (204)	[1] 60-100		[1] 120(250)	[3] 166(220) [3] 105(204)		[3] 250(300)	[1] 269-293			
228 APC's:										
Northeast China				[3] 60(185)						
Northwest China and Inner Mongolia				[3] 88(170)						
Central China				[3] 84(195)						
South China				[3] 133(222)						
Peking suburban commune: 1 commune										312(336)
Shensi			[1] 120+				[1] 180+		[1] 200+	
Honan: 1957, 1931 APC's			[3] 100-120	[1] 150-200 126						
Kiangsu:										
1956, 1 brigade			[1] 270							300
1972, 1 brigade			170							
Szechuan		[3] 68-110								
Kiangsi: 1961, 1 team		[3] 70					[1] 324 228-312			
Kwangsi			[1] 250							
Fukien:										
1961, 2 teams							216	264(312)		
1962, 1 brigade							288	216(240) 180(156)		
Hopei: 1 county	30(110-120)	70-80(170-180)	230(270)							

Note: If not otherwise indicated data refer to workdays performed, and if not specified under coverage, data refer to the whole region indicated under geographical area.

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[1] Officially planned.
[2] 10-fold increase.
[3] Average.

Notes to Table 11

All China

1954 (I)—Half-year: "The women's movement in New China," speech by Teng Ying-ch'ao, October 1951, published by the ACDWF in English in 1952.

(II)—one fifth to one third of all workdays. Chang Yun, Vice-Chairman ACDWF, "Constructively direct village women to take part in agricultural mutual aid cooperative movement," CKFN, No. 3, 1954.

1956—"Women of the whole country realize 'The draft for the whole country's agricultural development from 1956 to 1967'," JMJP, 1956.3.9.

1957 (I)—80–180: "Communist China 1955–1959, Policy Documents with Analysis," Harvard University Press, 1962, p. 119.

(II)—105(204): "Income and distribution of APC's in 1957," T'ung-chi yen-chiu (Statistical Research), 1958.8.23, in URS, Vol. 13, No. 1, 1958.10.3.

(III)—166(249): "People's communes are very good as an organization form for women's complete liberation." In commemorating the 50th anniversary of 8th of March International Working Women's Day. Hung ch'i correspondent, Hung Ch'i (Red Flag), No. 5, 1960.3.1.

1958—"Further emancipate female labor power, serve socialism in a greater, faster, better and more economical way", CKFN, 1958.7.1.

1961—Editorial, "Women make greater contributions to win a bumper harvest of crops this year", JMJP, 1961.3.8. The article says that village women should be given 6–8 days of rest every month which would mean 269–293 workdays in a year.

Northwest China and Inner Mongolia; Central China; and South China

Source: See *All China* 1957, II.

Peking—suburban area

Interview by Peter Nan Shou-Lee, in Peking suburban commune, 1972.9.24.

Shensi

1956—Shensi Provincial Democratic Women's Federation, "Determine a long-term plan for the work for women of the whole province", *Shen-hsi jih-pao* (Shensi Daily), 1956.4.15.
1961—Ibid.
1967—Ibid.

Honan

1956—The Honan Provincial Women's Federation calls a conference to discuss the problems of women having jobs. Manage well household work, practice equal work equal pay. Let women join agricultural production enthusiastically and happily", *Ho-nan jih-pao* (Honan Daily), 1956.9.9.
1957 (I)—150–200 (ibid).
(II)—126: Report by the Honan Statistical Bureau, "Women are a strong force in socialist construction," in *Ho-nan jih-pao* (Honan Daily), 1958.3.8., in *Weekly Report, Sum. 1916*, p. 12.

Kiangsu

1972—Investigation report from Kiangsu, Ch'i tung hsien, Lüszu commune, No. 10 production brigade, "Bring into fuller play the role of women as a labor force", *Hung ch'i* (*Red Flag*), No. 3, 1973.3.3.3., p. 43 ff.

Szechwan

"Working days of rural Szechwan women will in 3 years surpass the target set for the 7th year of the National Program for Agriculture", *NCNA*-English, 1956.3.9.
1956—Editorial, "Protect the health of rural women and children", *JMJP*, 1956.5.16.

Kiangsi

1955—A speech by the Chairman of the Kiangsu Democratic Women's Federation, Yang Tsu-hsing, "Actively mobilize women to join agricultural production", *Hsin-hua jih-pao* (New China Daily), Nanking, 1956.1.26.

1961—"Production team's arrangements of labor for collective production and housework cited", *JMJP*, 1962.5.29. in *CCD* No. 69, p. 16.

Kwangsi

Speech to the 2nd plenary session of the 1st Kwangsi Provincial Committee of the Chinese People's Political Consultative Conference, "Women's role in Kwangsi", *Kuang-hsi jih-pao* (Kwangsi Daily), 1956.4.28.

Fukien

1961—"YCL Branch studies way to help young women in acquiring working experience", *Chung-kuo ch'ing-nien pao* (China Youth Daily), 1961.9.3., in CCD, No. 53, p. 77.

1962—Editor C.S. Chen, *Rural People's Communes in Lien-chang,* Documents concerning communes in Lien-chang county, Fukien province, 1962–1963, 1969, p. 14 table 4.

Hopei

Cheng Lin-kuan and Lin Tsung-ho, "People's China", 1956.12.16.

In table 11 the highest number of workdays were given for the smallest units, all model units, while the lowest were either provincial average data or figures from national surveys.

For 1954 there is a plan telling women to devote 60–150 workdays per year to the collective and an example from a model unit telling about how little women worked before collectivization, only 30 days a year. This example, however, was taken from the wheat region in China where agriculture was not as labor intensive as in South China and because of that women traditionally worked less in agriculture than in the rice region in the South. The average provincial data given for two provinces in the rice region, Szechwan and Kiangsi, of 68–110 days a year in 1955 would amount to the requirements for taking part in busy season agriculture. The same was claimed for the model country in Hopei after the first cooperativization. A norm of 120 workdays was set for 1956 at the start of the year before the collectivization of agriculture and at the beginning of the campaign to mobilize more women for production.

It is interesting to see how the plans varied according to different regions of production. The *People's Daily* in connection with Women's Day in 1956 exhorted women in general to work 120 days per year in agriculture. Shensi in the wheat region planned the same number of days. Honan with most of the province in the wheat region, and only its southern tip in the Yangtze rice-wheat region claimed at the time of the autumn harvest that year that women on the average in Honan had accomplished 100–120 workdays. The plans, however, for Kiangsu with most of the province within the Yangtze rice-wheat region planned 270 workdays and Kwangsi in the southwestern rice region planned 250 workdays (see table 10). The 230 workdays claimed for the model county in Hopei in the northern wheat region is incompatible with the general trend here. The survey of 228 APC's in 1957 confirmed the regional differences just delineated with the greatest contrasts between the northern wheat region with 60 workdays and the southern double-cropping rice region with 133 workdays on the average (table 10).

Due to change in measurement the claims for 1958 and 1959 were inflated. If women on the average worked "10 times more than before" in 1958, they could at most have put in 35 workdays a year earlier, which is in conflict with both a national survey of 228 APC's in 1957 and the averages given for some of the provinces, for example Honan, Kiangsu and Szechwan in 1955 and 1956. The data from the survey of 228 APC's gave 105 workdays per year for women and 204 for men, for all China in the year 1957, while the data for *Red Flag*, published in 1960 referred to 166 workdays for women and 249 for men as the average for the whole year.

The long-term planning for Shensi in the wheat region published in 1956 set a target for women to perform 180 workdays per year in agriculture not later than 1961, while even in an example of a "bad" team in the southern rice region in Fukien the women worked 216 days. If the Kiangsi data from a model team in 1961 were representative, that would mean that women would have increased their number of workdays fourfold since 1955 when a provincial average of 70 workdays in a year was given.

The two highest figures claimed for women's workdays of 300 and 312 for the year 1972 are both from small model units which both are atypical. The brigade where women worked 300 days per year was situated in a community where most men spent their time in fishing. The commune with women working 312 days a year was a suburban commune, where part of the men already had left agriculture.

For the post-1960 period data refer only to very small units such as a models county or a team. Usually the units were shown as models to emulate. For instance, for Fukien in 1961 two examples were given; one of a bad team performing only 216 workdays a year while the women of the model team worked 288 days a year.[238]

Different criteria were used to establish norms for work in agriculture. One brigade based their quota of workdays for women on the extent of their household work and the number of children at home. Women were divided into four categories:

(1) Women without children or household work were required to work 24 days per month.

(2) Women with children cared for by family members and light household work had to work 20–22 days per month.

(3) Women with both children and household burdens were asked to work 15 days per month.

(4) Women with both children and household burdens and in bad health were required to work 12 days per month.

Category (4) encompassed 10 percent of the women in the brigade mentioned above.[239]

Another system practised in a production brigade in Fukien divided women and men by age. Women aged 16–40 had to work 22 days per month, men 16–50 worked 26, women 41–45 years of age 18 days and men 51–55 years of age 20 days, and finally women 46–60 were required to perform 15 workdays per month and men aged 56–60 13 workdays per month.[240]

Fukien supplied more data than any other province. It was estimated that 80 percent of all women 15 to 59 years worked in agriculture in 1958 (see table 4). This estimate was considered exaggerated (see text after table 4). For 1957 we calculated that 63 percent of the women of working age took part in farm work. The same source that our calculation was based on estimated that only 30 percent of the women worked full time and 50 to 60 percent of the women labor power worked part time in South Fukien, while as little as 10 percent of the women worked full time and 20 to 30 percent part time in North Fukien in 1957.[241] Work attendance by women was 50 to 60 percent, in some districts 10 percent.[242] In the *People's Daily* in 1973 an example was given of a hsien in North Fukien where 35 percent of the female labor force worked full time before 1973.[243] That is consistent with earlier data of 10 and 20 to 30 percent for 1957.

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[238] "YCL Branch studies way to help young women in acquiring working experience", Chung-kuo ching-nien pao (China Youth Daily), 1961.9.3. in CCD, No. 53, p. 77.

[239] "Jui-chin hsien Women's Federation Work Section Ch'ing hsi production brigade carries through equal pay for equal work for men and women, CKFN, No. 11, 1961, p. 4–5.

[240] Editor C.S. Chen, "Rural People's Communes in Lien-chang," Documents concerning communes in Fukien Province, 1962–1963, 1969, p. 14 table 4.

Earlier it was shown that there was a positive correlation between number of women in agriculture and amount of time spent in farm work. In one brigade in northeast Fukien women made up 23 percent of the full-time labor power in 1962.[244] Women made up 40 percent of all working in agriculture in a model brigade in 1971.[245]

Women in full-time work made up 10 and 20 to 30 percent of the women labor force in 1957, while on the average 63 percent of all women took part in farmwork. Assuming that 35 percent of the women worked full time in agriculture up to 1973 about 70 percent of the women can be expected to have taken part in farmwork. This is consistent with our estimate of 60 to 70 percent of the women labor force in agriculture up to 1974, where the higher range is for south and the lower for north China.

If women make up 40 percent of all persons working in agriculture in 1971, it would mean that about 80 percent of all women worked in agriculture and 35 percent of them were full-time laborers (as in our example above).

Thus for the early 1970's one-third of the able-bodied women worked full time, that is, more than 250 days per year, while two-thirds worked less than 150 days per year. Since women made up 40 percent of all persons working in agriculture, women working full time were a third of that, which would mean that women working full time in agriculture made up 13 percent of all persons working in agriculture.

Women made up 23 percent of the full-time labor in 1962. If we assume 28 percent for the early 1970's, we would have 46 percent of the men and 13 percent of the women in full-time work, while 27 percent of the women and 14 percent of the men would be working part time in agriculture. This would mean that two-thirds of the women and one-third of the men worked part time and two-thirds of the men and one-third of the women worked full time.

CHILD CARE FOR VILLAGE WOMEN

Child care facilities were expanded in the rural villages from the time of the first campaigns in the early 1950's urging women to take part in agricultural production. The availability of child care and the demand for women's labor were positively correlated. Increased demands on women to work in agriculture led to more child care stations being established, though with a timelag. At the time of the first massive campaign to mobilize women for agricultural production in 1956 only 7 to 10 percent of the children whose mothers worked in the fields could be placed in the temporary busy season child care stations. The great discrepancy between supply of child care facilities and demand for women's labor during 1956 forced women to shoulder a double workload leading to a peak in accidents and miscarriages in that year.

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[241] Editorial "Wish all the village women to be heroines," Fu-chien jih-pao (Fukien Daily), Mar. 25, 1958;

[242] Ibid.

[243] "Shun ch'ang county committee seriously carries through the policy of equal work equal pay for men and women", JMJP, May 13, 1973.

[244] C.S. Chen, 1969, p. 12. Fukien PRS, URS, Vol. 62, Mar. 19, 1971.

[245] "Communes in Shao-wu county implement the principle of 'equal work equal pay' between men and women", Fukien PRS, URS, Vol. 62, Mar. 19, 1971.

In 1957 the demand for women's labor fell off and led to a small decline in the availability of child care facilities in the busy season in agriculture. The reorganization of rural life in 1958 drew most women into outside work and greatly expanded child care facilities. About one-half to three-fourths of all children under 7 years of age whose mothers worked outside were cared for by the kindergartens and nurseries. Because of greatly expanded child care facilities and the opening up of messhalls women could be fully employed in agriculture without being overworked as they were during 1956.

The poor harvests in 1959, bad weather, mismanagement, and administrative chaos all contributed to a decentralization or a closing down of many of the collective organizations set up during the preceding year. When the economic crisis set in, services that women traditionally had provided free to society were the first to be scrapped.

In the early 1960's fewer women took part in agriculture and thus many mothers with small children were not mobilized, reducing the demand for collective child care. Mothers still working were told to make up for inadequate child care by making private arrangements, using mothers-in-law and women neighbors. Increasing demands during the 1960's for women's labor in agriculture in combination with a sequence of good harvests contributed to an expansion in child care facilities. This trend continued in the 1970's.

The First Five-Year Plan Period

In 1951, about 14,000 temporary child care stations were organized in the Chinese countryside. Already in 1952 the number of seasonal crêches showed a more than tenfold increase to 148,200 that looked after 850,000 children.[246] As mutual aid and cooperativization in Chinese agriculture increased, women were encouraged to set up child care stations on a mutual help basis.[247]

Even though mothers-in-law could be used to relieve women of some of their double workload, demands for collective organizations of childcare, canteen, et cetera increased sharply when massive campaigns in 1956 tried to draft many more women for busy season farmwork. An editorial in the *People's Daily* stressed the importance of child care and the dire consequences of neglecting it:

> While agricultural production is the main form of labor in rural areas, to take good care of the household and the children is also labor of social significance. . . . With increased participation in agricultural production by women the number of accidents, including deaths among women and children, has increased rapidly. Women have miscarriages because of overwork and children die because there is nobody to look after them.[248]

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[246] Speech by Teng Ying-ch'ao at the 2d All-China Women's Congress. "A basic summing up of the Chinese women's movement during the last 4 years and the tasks from now on" HCKFN, No. 5, 1953, p. 10.

[247] "In the north region not a small number of villages establish agricultural busy (season) child care mutual help organizations," JMJP, Mar. 31, 1953.

[248] Editorial, "Protect the health of rural women and children." JMJP, May 16, 1956.

In addition to equal pay for equal work and labor protection, the introduction of temporary busy season child care stations was regarded as one way of getting more village women into the fields. In Shensi province the establishment of this type of child care station was included in long-term planning.[249] A regional Hunan Women's Federation called for building of child care stations on a large scale.[250] In Sinkiang the number of temporary busy season child care stations increased from 222 to 916 in connection with a drive to get more women out into cooperative production, while there were in all 60 child care stations of a more permanent character for 204 cooperatives.[251] The seasonal requirements for women's labor were here clearly apparent. Reports from Kwangtung and Inner Mongolia confirmed the positive effects of child care on women's labor force participation and labor attendance rates.[252] In Inner Mongolia 154 child care stations operated with 6,160 children in 1957. Compared to 1953 this was a threefold increase.[253] In Shantung Province two types of busy season child care stations were set up in the rural areas in 1956, 11,440 "infant team" nurseries caring for 113,000 babies and 19,186 kindergartens handling over 199,000 children.[254]

Pressures to enlist more women on the agricultural front relaxed in 1957. That explains the decrease in the number of child-care stations in Shantung in 1957 when a total of 25,500 nursery organizations looked after 250,000 children, against a total of 30,630 child-care organizations caring for 312,000 children during the preceding year.[255]

Shantung had a population of 54 million at the end of 1957.[256] Assuming a population growth of about 2 percent, there would have been a population of about 53 million at the end of 1956.

The agricultural population made up 80.5 to 83.4 percent, and 81.3 to 84.2 percent in 1956 and 1957, respectively, of the total population (see after table 2, calculations for the years 1949–60). If children under 7 constituted 22 to 24 percent of this population, there would have been 9.3 to 10.6 million children in the agricultural population in 1956 and 9.6 to 10.9 million children in 1957.[257]

According to earlier estimates, 70 percent of all able-bodied women worked in agriculture during the busy seasons in 1956. Let us assume that most of the 30 percent of able-bodied village women not working in busy season agriculture were those burdened with the largest number of small children and/or those with no mothers-in-law.[258] If 30 percent of those women had about 35 percent of the children, there would have been 6 to 6.9 million children whose mothers took part in farmwork. Of these children, 312,000, 4 to 5 percent, were cared for by organized child care. The remaining 5.7 to 7.6 million children had to be cared for in other ways.

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[249] Shensi Provincial Democratic Women's Federation, "Determine a long-term plan for the work for women of the whole province," Shen-hsi jih-pao (Shensi Daily), Apr. 15. 1956.

[250] The Provincial Women's Federation, the branch organization at Heng Yang region, "Use practical action to commemorate March 8," Nung-min pao (Peasant's Daily), Hunan, Mar. 7, 1956.

[251] (I) At the third session of the First People's Congress of the Sinkiang Uighur Autonomous Region speech by delegate Mu-ai-t'a-ni-wu-la-wa, "Hope to pay attention to women's work," Hsin-chiang jih-pao (Sinkiang Daily), Aug. 14, 1956.

(11) At the third session of the First People's Congress of the Sinkiang Uighur autonomous region, "Speech by delegate Ai Yi-mu," Hsin-chiang jih-pao (Sinkiang Daily), Aug. 9, 1956.

[252] (I) "Mobilizing women to participate in summer plowing solved a great problem," Nei-meng-ku jih-pao Inner Mongolia Daily), July 6, 1956.

(II) "After the policy of equal work equal pay for women and men is carried out and child-care stations are set up women cooperative members in Hsia Nan county are actively present at work," Nan-fang jih-pao (Southern Daily), Canton. Aug. 24, 1956.

[253] Wu-lan Chairwoman of Democratic Women's Federation of Inner Mongolia Autonomous Region "Women of all nationalities in the Inner Mongolian Autonemous Region moving ahead", Nei-meng-ku jih-pao (Inner Mongolia Daily), Apr. 27, 1957.

[254] "Many agricultural cooperatives in our province are concerned about the special benefits for women," Ta-chung jih-pao (Masses Daily), Tsinin, 1956.11.13.

[255] "Walking on the socialist road is the base for women's liberation," Ta-chung jih-pao (Masses Daily). 1957.8.24.

[256] J. S. Aird, "Population Growth and Distribution in Mainland China." in Joint Economic Committee, Congress of the United States, "An Economic Profile of Mainland China." vol. 2, 1967 (hereafter referred to as J. S. Aird, 1967), p. 370, table 7.

[257] Data are derived from my forthcoming dissertation. This shows 36 to 40 percent of the population under 14. Given the broad base of China's population pyramid, this would mean that roughly 60 percent of the 36 to 40 percent were under 7 years of age, which would mean 22 to 24 percent.

The proportion of women taking part in farmwork decreased during 1957. According to earlier estimates, 50 to 65 percent of the able-bodied women in the agricultural population took part in farming in 1957. If 35 to 50 percent of the women not working in agriculture had about 40 to 55 percent of the children, there would have been 4.3 to 6.5 million children whose mothers worked in the fields. Of these, 250,000 children, about 5 percent, were in child-care institutions, while the rest of 4 to 6.2 million had to be cared for in other ways.

If the Shantung data are representative of China in 1956 and 1957, then obviously more organized child care was needed. However, Shantung seems to have had a smaller proportion of children in organized child-care facilities than the average for China in 1956, based on data for China as a whole given below. Reports from Kansu and Shensi showed that not only were more busy season stations called for [259] in Kiangsu but better management was particularly stressed:

> But attention should be paid to this that no matter how the child-care station is run, some person should be put in charge of it. Never let children by left alone, because the enthusiasm for production can be influenced if accidents happened.[260]

Suggestions were put forward of how to better organize childcare and reduce women's double workload.[261] In a speech, the Vice Chairwoman of the ACWF, Chang Yün, disclosed that for almost 300,000 children looked after by the Women's Federation and the trade unions, on the average 1 person looked after 22 children.[262] Women were sometimes even held responsible for not being able to manage double workloads:

> In an agricultural cooperative in Honan 32 women fell ill because of overwork and lack of sleep, but they were well again a few days later. The public calls this the general disease and doesn't pay much attention. Because there was no time for women to do housework, according to statistics from 93 cooperatives, 183 family quarrels occurred because children and husbands needed shoes[263] and in addition could not get regular meals, What is needed are child-care stations, busy season canteens and sewing groups.[264]

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[258] T'ien Hsiu-chiang, ACDWF Secretariat, "Promote women's work in Ho wen hsien" in JMJP, 1958.6.-12. In this article it is mentioned that when carrying out propaganda for family planning, the authorities found that 29 percent of the women could not join production because of giving birth to too many children.

[259] (I) The Investigation and Research Team in Farm Work of the CCP in the region south of Yin Ch'uan town, "Ways to solve the problem of women going to work in the fields," Kan-su jih-pao (Kansu Daily) 1956.6.25.
(II) Editorial, "Set examples for village women," Hsi-an jih-pao (Sian Daily), 1956.9.20.

[260] At the 5th meeting of the Kiangsi Provincial People's Congress, speech by delegate Chou Han-chen "Something about the protection of female labor power and the care of the specific benefits of female cooperative members." *Chiang-hsi jih-pao* (Kiangsi Daily), 1956.11.10.

[261] Speech by delegate P'i Lu-ying, "Correctly solve the problem of village women's work in rural areas," Chiang-hsi jih-pao (Kiangsi Daily). 1956.11.13.

[262] Speech by Chang Yun, "To give fuller scope to women in the role of building socialism," HHPYK, No. 17, 1957, p. 46 ff.

[263] Referring to cloth shoes traditionally stiched by women. One pair of shoes usually required 2 day's work to make and lasted a few months.

[264] "At the 5th session of the 1st People's congress In Hunan. Speech by delegate Lin Wen." "Reasonably settle the contradiction between women joining production and their household work," Ho-nan jih-pao (Honan Daily) 1956.11.27.

According to a speech by Minister of Public Health, Li Teh-ch'uan,[265] in all 634,640 rural child-care stations had received 6,106,272 children in 1956.[265] Assuming a Chinese population of 626 to 633 million in the year 1956 and that 80.5 to 83.4 percent of this population was agricultural (see calculation after table 2), there were 504 to 528 million Chinese in the agricultural population. If children under 7 constituted 22 to 24 percent of this population, there would have been 111 to 127 million children in the farm population. According to estimates, 60 to 70 percent of all able-bodied women worked in agriculture during the busy seasons in 1956. Assume that most of the 30 to 40 percent able-bodied village women not working in busy season agriculture were those burdened with the largest number of small children and/or those with no mothers-in-law. If 30 to 40 percent of those women had about 35 to 45 percent of the children, there would have been 61 to 83 million children in the agricultural population whose mothers took part in farmwork during the busy season. Of these children, 6.1 million, 7 to 10 percent, had been taken care of by busy farm season child-care stations. The residual of 55 to 77 million children were necessarily cared for in other ways, by elderly women, or taken along to the work in the fields, or left to themselves.

In an article translated into English, one example was given of a collective that had laid down the rule that women were not permitted to do outside work, unless they had made adequate provisions for child care.[266] This rule stands in contrast to articles in local Chinese papers telling about women who had to attend to work, meetings, and so forth, regardless of whether or not child care was available.[267]

The Great Leap Period

The formation of rural people's communes in 1958 meant a total reorganization of rural life.[268] Through collectivization of private life, women were to be released for production. Canteens, kindergartens, and service stations were set up on a grand scale. In Shantung there were a total of 189,000 kindergartens in late 1958.[269] That would mean an increase of 7½ times above the number in 1957. In early 1959, 64 million children were cared for in nurseries in all of China, compared to a total of 6.4 million for 1957. Of these 6.4 million children, 6.1 million were taken care of in child-care stations in the rural areas.[270] Assuming the same relationship between urban and rural areas for 1959 as for 1957, would mean that 61 million children in the countryside received collective child care.

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[265] Speech by Li Teh-ch'uan, Vice Chairwoman of the ACWF, at a women's representative conference, "Development conditions of women's and children's sanitary work," JMJP, 1957.9.15.

Chang Yün, Vice Chairwoman of the ACDW, had just before given the rough estimate of 6 million children being cared for in a speech, "Fight to develop socialism and manage with industry and thrift," CKFN, No. 10, 1957.10.1:

[266] China in Transition, selected articles 1952–56 by writers for China Reconstructs, Peking 1957, p. 317 ff.

[267] (I) "The forum for health protection of women and children and equal pay for equal work," Ch'ing-hai jih-pao (Tsinghai Daily), 1957.1.17.

(II) "The new contradiction after women take part in construction," Che-chiang jih-pao (Chekiang Daily), 1957.5.25.

[268] See section "Women and Overwork."

(I) "The great starting point of communism—get household work organized," Chung-kuo ching-nien (China Youth), 1958.7.1.

(II) "Organize the life of the masses, liberate women's labor power," CKFN, 1958.7.16.

(III) "Women have come from household work to liberation," JMJP, 1958.7.2.

[269] Editorial, "Organize more women to join spring plowing and harvest!" JMJP, 1958.10.13.

[270] "On the new stage of the women's movement," CKFN, 1959.5.16., p. 1 ff.

The agricultural population made up 78.3 to 81.1 percent [271] of an estimated total population of 651 to 665 million at yearend of 1958.[272] Assuming children under 7 years of age still made up 22 to 24 percent of an agricultural population of 510 to 539 million, there would have been 112 to 129 million children. From 80 to 95 percent of all able-bodied village women were estimated to have particpated in agricultural production, while 5 to 20 percent of the women with about 10 to 25 percent of children did not take part in farm work. Thus of 84 to 116 million children whose mothers worked in the fields as many as 61 million children, 53 to 73 percent of all, were taken care of by the child care stations, while 23 to 55 million were cared for in other ways. In some places it was claimed that up to as many as 85 percent of all pre-school-age children had been admitted to the child care stations.[273]

Old attitudes such as favoring one's kin were hard to uproot and could sometimes endanger the purpose of the child care stations:

> Nurses in the nurseries and kindergartens adopted the attitude of treating their relatives better than those children unrelated to them with the result that almost 9 out of 10 children placed under their care became ill. This worried the mothers, who thus could not concentrate on production. Because of this state of affairs, many mothers were reluctant to send their children to the nurseries and kindergartens and it appeared as if the nurseries and kindergartens would collapse.[274]

Still the number of child care stations were on the increase. The number of children under the care of child care stations in 1958 increased 7 times over 1957, while the number of children in kindergartens increased 26 or 27 times.[275] A total of 3,186,292 child-care stations were in existence in 1958 in all of China.[276]

By March 1959, 67.7 million children, it was claimed had been admitted to 4.98 million child-care stations and kindergartens, which was called the equivalent of more than 70 percent of the pre-school-age children.[277] If 67.7 million children equalled 70 percent of all pre-school age children, there would have been a total of 96.71 million children in March 1959. Children under 7 made up 22 to 24 percent of the total population. The 1958 yearend population was 651 to 665 million,[278] which would mean 143 to 150 million children of which the children in child care stations, 67.7 million, made up 42 to 47 percent. Thus the claim refers to children with working mothers, not all children under 7 years of age. 67.7 million children in 4.98 million child care stations average to 14 children per station. Earlier it was disclosed that on the average 22 children were looked after by one person.[279] Hence, if on the average there were about 14 children per station and on the average 1 person looked after 22 children, most child care stations were staffed by a single person. This staffing pattern explains the warning issued earlier against never leaving children alone.

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[271] See calculation after table 2.

[272] See data in my forthcoming dissertation.

[273] "New life of women in the agricultural people's communes", Chung-kuo hsin-wen (China News Service), 1959.2.24.

[274] "Reform mess halls and nurseries", Shui chiao nung min pao (Canton Suburbs Peasant News), 1959.1.7 URS, Vol. 14, No. 24, 1959.3.24., p. 361.

[275] (I) "Women enthusiastically plunge into the movement for increasing production", JMJP, 1959.8.20
(II) National Women's Federation summons the leaders of the Women's Federation in the provinces' municipalities and autonomous regions to an enlarged conference, "Further mobilize women in the whole country to plunge into the high tide of 'increase production and practice thrift movement, CKFN, 1959.9.1."

[276] "Several hundred millions of village women released from household labor, became a brave main force in production", Chung-kuo ching-nien pao (China Youth Daily), 1959.9.23.

[277] "The great development of collective welfare work and a new phase of women's complete emancipation," JMJP, 1959.3.7.

[278] See data in my forthcoming dissertation.

[279] "Several hundred millions of village women, released from household labor, became a brave main force in production," Chung-kuo ching-nien pao (China Youth), 1959.9.23.

An estimate was made that 53 to 73 percent of the children of working mothers were admitted to child care stations. A few data from Tientsin showed a somewhat lower level, though it was a suburban area. Earlier it was disclosed that in general a higher proportion of the women were working in suburban than in rural areas. Thus, a higher proportion of pre-school-age child-care stations was to be expected in suburban areas. During 1958 and 1959 in the Great Leaps Forward in agricultural production Tientsin's rural women's labor force totaled upward of 1,790,000 or 93.6 percent of the total women's labor force. From 60 to 80 percent of the total labor force of men and women regularly engaged in production. In 1959 Tientsin had 75,659 child care stations and kindergartens of which 71,406 were in rural areas. There were a total of 784,822 children in the child care stations.[280] Women of working age made up around 27 percent of the total population in the late 1950's,[281] while children made up 22 to 24 percent.[282] Hence the total women labor force was 2.13 million in a total population of 10.24 million of which children made up 2.25 to 2.46 million. Assuming that the 20 to 40 of the women not working regularly had 25 to 45 percent of the children would mean 1.35 to 1.69 million children with working mothers. Of the total, 784,822 or, 46 to 58 percent were admitted to child care stations.

TABLE 12.—NUMBER OF CHILDREN IN CHILDCARE STATIONS IN 5 CHINESE PROVINCES AND IN ALL OF CHINA IN 1958

Geographical area	Population year end (in millions) (I)	Number of children under 7 in the population (22–24 percent) (in millions) (II)	Number of children in child care stations (III)	Percent of all children in child care stations (IV)	Number of child care stations (V)	Average number of children in each child station (VI)
All China	651–665	143–160	64,000,000	40–45	3,186,292	20
Hopei	49.5	10.89–11.88	3,780,000	32–35	0,189,498	20
Szechwan	73	16.06–17.52	10,500,000	60–65	0,710,000	15
Kweichow	17	3.74–4.08	2,253,034	55–60	0,283,784	8
Yünnan	19	4.18–4.56	1,730,000	38–41	0,088,000	20
Chekiang	26	5.72–6.24	1,456,600	23–25	0,102,200	15

SOURCES

All China—(I) CKFN special commentary, "Discussing the new stage in the women's movement", CKFN, 1959.5.16., p. 1 ff. (II) "Several hundred million village women, released from household labor have become a brave main force in production", Chung-kuo ching-nien pao (China Youth Daily), 1959.9.23.

Hopei—"The vast number of women in our province become an important force on the production front", Ho-pei jih-pao (Hopei Daily), 1959.9.26.

Szechwan—Tai K'o-yu, Vice-Chairman, Szechwan Provincial Women's Federation, "Hail the mighty achievements of the Szechwan women's movement", Ssu-ch'uan jih-pao (Szechwan Daily), 1959.9.29.

Kweichow—Kweichow Provincial Women's Federation, "The development of female and child welfare services in our province in the last 10 years", Kuei-chou jih-pao (Kweichow Daily), 1959.9.15.

Yünnan—Fang Wen-chien, Vice Chairman, Yünnan Provincial Federation, "The Great Leap Forward of the women's movement", Yün-nan jih-pao (Yünnan Daily), 1959.10.12.

Chekiang—"Thirteen million in Chekiang's commune mess halls," Che-chiang jih-pao (Chekiang Daily), 1959.11.9. in CCD, No. 14, p. 29.

The provincial population data (column I) have been derived from J. S. Aird 1967, page 370, 1957 year-end data, and a 2 percent growth rate assumed. The national population data are for my forthcoming dessertation. All provincial data are from articles written in commemoration of the 10th anniversary of the founding of the PRC. In the Chinese text the data referred to year-end 1958, except for Chekiang which is referred to as "at present."

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[280] Data on women workers in Tientsin, Hsin Wan Pao (New Evening Paper), 1959.11.14. in Weekly Report, No. 22, 1960.4.25.

[281] See population tables in my forthcoming dissertation.

[282] See footnote 257.

In table 12 (above) the data all refer to provincial or national levels, and are not limited to the agricultural population. The articles, however, stressed that the establishment of child care stations was in the main carried out in rural areas to help women who worked in agriculture (sources see under table 12). In table 12 the percentages of all preschool age children are given. If only the children with working mothers were counted that would mean an increase of about 5 percent (in column IV, table 12) for the year 1958. The national data given for all of China are consistent with the provincial data. Compared to earlier data from 1956 when 5 to 10 percent of the children of working mothers were admitted to child care stations a substantial increase occurred in 1958. From roughly one-third to two-thirds of the children with working mothers received child care.

Child care stations with one person in charge were obviously common in 1958, considering the low average number of children per station (see table 12, column VI). That would have meant most likely an elderly women looking after some of her neighbors' children in her own courtyard.

In 1959 smaller figures were given, indicating a decrease in the number of children in kindergartens. In an excerpt of Ts'ai Ch'ang's speech in the People's Daily[283] a reference was made to several million canteens, nurseries, and kindergartens, while the same passage of the same speech reprinted in the official organ of the ACWF, *Chung-kuo fu-nü* (*Women of China*), said that several hundred thousand pre-school-age children were cared for by child care organizations.[284]

Recession in the 1960's

In 1961 a rule was recommended for assigning women to farmwork taking into account their number of children. Mothers with children under the care of their families had to work 20 to 22 days per month, while mothers who had to take care of their children by themselves and had a heavy household burden had to work 15 days per month.[285] The alternative of collective child care was not mentioned.[286] Child care stations were seen mainly as a busy season phenomenon:

> If mothers need others to care for their children during the busy seasons in agriculture and when all (labor) power has to be united to accomplish a heavy work burden in a short time then temporary child care stations should be set up to care for the children during this time.[287]

In exhorting more women to take part in agricultural production in 1965 women first had to be helped to solve what was considered "their practical problems."

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[283] "Hold high the banner of Mao Tse-tung thought, further mobilize women to realize the struggle for a continuing Leap Forware in 1960." Excerpts from a speech by Ts'ai Ch'ang, Chairman ACWF. on its second meeting third executive committee. JMJP, 1960.2.25.

[284] "Sisters in the whole country! Quickly again whip up and carry through the continued Great Leap Forward of 1960!" Report by Chairperson Ts'ai Ch'ang of the ACDWF, to the second meeting of the third executive committee of ACDWF, 1960.2.22., CKFN, No. 5, 1960.3.1., p. 2 ff. A translation of the *CKFN* article above was made in JPRS 5043 "Women's movement in Communist China," mistranslating the above passage into "in rural areas about 70 percent of the children of suitable age are admitted to the series" where the Chinese text said preschool age children and several hundred thousand.

[285] "The Ch'ing hsi production brigade carries through equal pay for equal work for men and women," *CKFN*, No. 11, 1961, p. 4.

[286] Ibid.

[287] Propaganda Department Women's Federation of Peking, "Materials for teaching duties in working with rural women," *CKFN*, No. 2, 1962.2.1.

> In particular many poor and lower middle peasant women are in urgent need of help to solve their practical problems in life so that they may do more work for their teams. For example, how are they to solve the problems of child care, cooking, making clothes and shoes etc.? * * * We should appreciate that only when these problems have been seriously solved can women be freed from their worries and their enthusiasm for collective labor reinforced.[288]

Hence the problems of child care for village women still awaited a solution.

Even if women got collective child care for their children, they still did not stop worrying about them, which hampered their work zeal:

> If we put our children first, small difficulties will be big ones, we must believe that child care stations can bring up children better than we ourselves.[289]

A regional conference on women's work held in Huhehot, November 6–17, 1972, particularly stressed that:

> It is necessary to take actual conditions into consideration and gradually restore and improve child care, care for babies and women and child health organizations.[290]

That might imply that there were fewer child care stations in operation than during the peak in 1958–59. In one region of Shansi province over 9,400 child care stations took care of 106,000 children in 1972.[291] That would imply 12 children on the average for each station.

During my own visit to China in February–April 1973, model communes outside Peking, Nanking, Shanghai, and Wuhan had as a rule child care stations. Most of them were run by the production brigades. A number of children however, were cared for by their grandmothers. With increasing diversification of the economy in the rural people's communes, the number of women working full time will increase and so will the demands for more and for permanent child care stations. The combined effects of a sequence of good harvests, a higher educational level, delayed marriage, and family planning make the expenses for child care a more marginal burden than it was in the 1950's. Women working in the 1970's are better educated, work more years before marriage and have one child less than in the 1950's. Hence rural people's communes will gain more on organizing child care in the 1970's than they did earlier.

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[288] Editorial, "Fully arouse rural women to take part in collective labor," *Pei-ching jih-pao* (Peking Daily), 1965.10.11. in *SCMP*, Supplement No. 148, 1966.3.1., p. 30.

[289] Editorial, "Sisters, Become Perfect in Fighting Enthusiastically for Production," *CKFN*, No. 16, 1964, p. 1–3.

[290] (italics mine)

[291] "Inner Mongolia holds Regional Conference on Women's Work," Inner Mongolia RS in Mandarin, 11 00 GMT, 1972.11.20. in FBIS-CHI-72–229, No. 229, vol. 1. p. F 1, 1972.11.27. "Shansi Region Women's RS, Role," Taiyuan Shansi RS, in Mandarin, 23.00 GMT 1973.1.17. in FBIS-CHI-73–13, No. 13, vol. I, F 3, 1973.1.18.

Part IV. AGRICULTURE

CHINA'S AGRICULTURAL PRODUCTION

By Henry J. Groen and James A. Kilpatrick

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I. INTRODUCTION

Agriculture in the People's Republic of China is a mixture of modern and premodern elements. Elements of the traditional agricultural system continue to exist throughout the countryside, and in most areas modernization has proceeded slowly. Even where modernization is most advanced, traditional methods have persisted and been adapted to take advantage of new inputs and methods of production.

In most respects agriculture remains today what it has always been—subsistence-level production involving the great bulk of the labor force. Despite the large proportion of workers now involved—80 percent of the labor force—agriculture accounts for less than one-fourth of China's gross national product. Since 1949 agriculture has grown much slower than industry. Because of its strategic place in the economy, it nonetheless is accorded the highest degree of importance in development plans.

The agricultural sector's primary role is production of food. The Chinese must feed nearly one-fourth of the world's population—1 billion people—on the products of only 7 percent of the world's arable land. This is accomplished by an intensive system of agriculture which is as much like gardening as it is like farming.

Agriculture also provides raw materials to industry, and in turn it has increasingly become a market for many of industry's products. In addition, agriculture provides products for export and is the country's most important source of foreign exchange earnings. These earnings more than pay for the grain, sugar, and other agricultural products which are imported.

Because of this central role, fluctuations in agricultural production have a disproportionately large effect on the rest of the economy. The Chinese do not view agricultural development as their most significant ultimate economic aim. It is important in the long run mainly as a means of supporting industrialization. At the present stage of economic development, however, planners and leaders acknowledge that agriculture must have first priority.

This paper is devoted mainly to describing the present situation in Chinese agriculture and its recent development. Because of the sheer size and complexity of the agricultural sector, change is slow and growth is hard won. Evaluation of agriculture's present ability to meet the demands of the economy provides some insight into the likelihood of future demands being met.

The main body of this paper consists of seven sections. Section II, which is on resource endowment, gives some perspective on the problem of feeding a huge population on a limited amount of arable land. Section III describes changes in agricultural development policy over time. Section IV discusses grain production, which accounts for nearly one-half the total value of agricultural output, as well as industrial crops, livestock, and other types of output. Section V discusses factors of production and their modernization. Sections VI and VIII, which are on trade and consumption, are brief discussions of current trends. Section VII on agricultural development problems and prospects discusses the likely future course of agricultural development in China given present capabilities and the strengths and weaknesses of current programs.

II. CHINA'S RESOURCE ENDOWMENT

A. Land

The history of the development of Chinese agriculture has been marked by the expansion of the population onto new arable land, and by increasing unit yields on land which was already cultivated.[1] As new land that could be readily cultivated has become scarcer, and as the population has increased, the importance of unit yields has become greater. By now about the only feasible way to raise agricultural production is to raise yields on land that is now cultivated, and most current agricultural programs are designed with this in mind.

While the total land area of the PRC is about the same as that of the continental United States, only 11 percent can be cultivated as farmland, compared to about 22 percent in the United States. Efforts to increase the arable area continue, but increases are hard and expensive to win. The land that is not already cultivated is not very fertile, and yields on some of the marginal lands now in cultivation are low.

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[1] See Perkins, Dwight H., *Agricultural Development in China 1368-1968.* Chicago: Aldine, 1969.

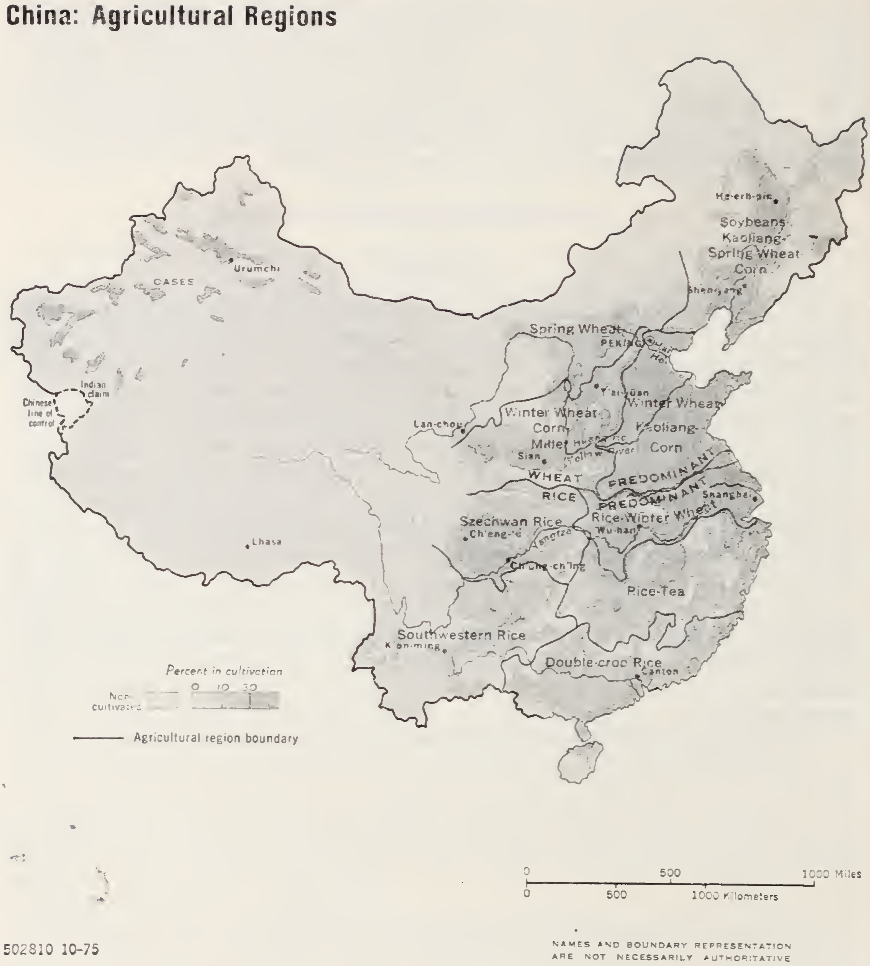
China: Agricultural Regions
Ha-erh-pin
Soybeans-Kaoliang-Spring Wheat-Corn
Shen-yang
Urumchi
OASES
Spring Wheat
PEKING
Indian claim
Chinese line of control
T'ai-yüan
Winter Wheat-Kaoliang-Corn
Lan-chou
Winter Wheat-Corn-Millet
Hwang Ho
Yellow River
Sian
WHEAT PREDOMINANT
RICE PREDOMINANT
Shanghai
Rice-Winter Wheat
Wu-han
Szechwan Rice
Ch'eng-tu
Yangtze
Ch'ung-ch'ing
Lhasa
Rice-Tea
Southwestern Rice
K'un-ming
Double-crop Rice
Canton
Percent in cultivation
Non-cultivated
0 10 30
Agricultural region boundary
0 500 1000 Miles
0 500 1000 Kilometers
502810 10-75
NAMES AND BOUNDARY REPRESENTATION ARE NOT NECESSARILY AUTHORITATIVE

FIGURE 1

Natural divisions of climate and topography separate the main agricultural area, the eastern half of the country, into two broad segments—North and South China—with the break occurring roughly at the Yangtze River[2] (see figure 1). The river separates the high-precipitation, semitropical South from the drier North, where precipitation is more seasonal. Agriculture in the South is based upon paddy rice, while in the North the base is dry land crops, especially coarse grains and wheat.

In the rice region, the climate permits a longer growing season and multicropping of large areas. Soils are poor, but the supply of water is adequate, and the density of both human and animal population means that large amounts of organic fertilizer are available. Chinese rice yields per unit of sown area are much higher than in most developing countries because of intensive fertilization and the adaptation of agricultural techniques to suit local circumstances. In the North, on the other hand, yields are relatively low overall, although wheat yields are similar to those obtained by other LDC's.

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[2] See Buck, John Lossing, *Land Utilization in China*. Nanking: University of Nanking, 1937.

China's agriculture has been characterized historically by intensive inputs of labor on a limited supply of land. Steady expansion of multiple cropping, exacting crop rotations, improved irrigation and heavier use of organic fertilizer have enabled the Chinese over centuries to extract even higher annual yields per unit of cultivated land. Steady technological progress has been part of the adaptation of the large and growing population to given resources. As population pressure has become particularly intense in the second half of this century the adoption of modern inputs such as agrochemicals and mechanization has become a necessity.

Yields per acre have increased over time in many areas to a very high level. But even so, population increases have eaten up virtually all of the gains in output (see fig. 2). Grain production per capita has been just at the subsistence level for centuries, and it remains there today. Chinese agriculture has been vulnerable to frequent natural disasters and fluctuations in output which in the past have often led to localized famine. Unequal distribution of production and agricultural income persist despite the efforts of the government to reduce these inequalities in the countryside.

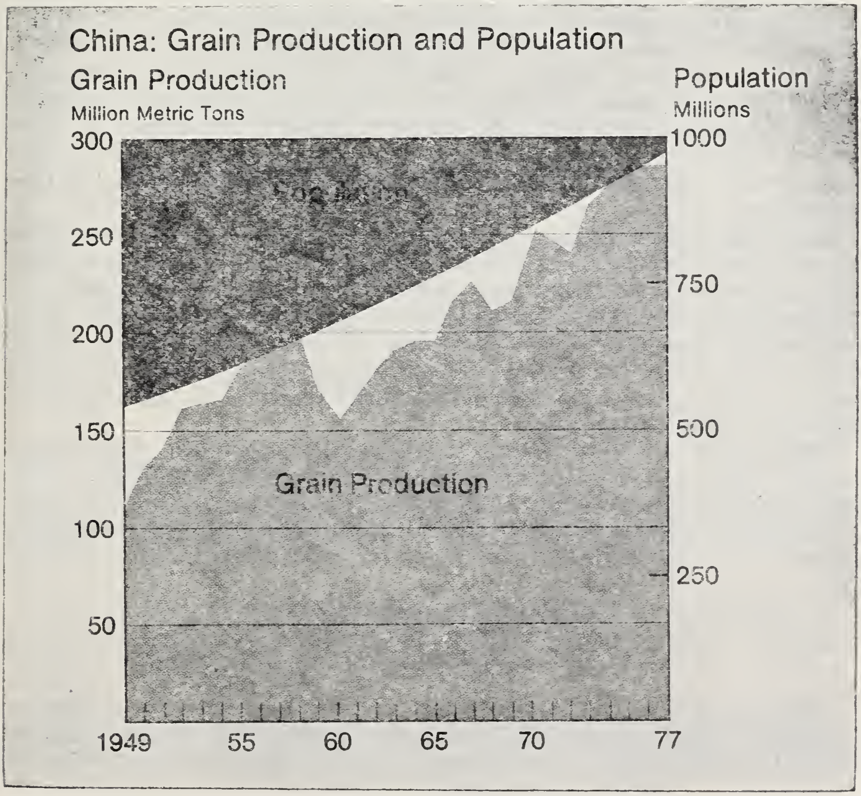

FIGURE 2

B. Population

The Chinese have not taken a formal census since 1953, and they have not released precise population figures since the 1950's. Aird estimates that the population was just over one billion as of July 1, 1978, and that the rate of increase will decline rapidly over the next few years from about 2 percent to less than 1.5 percent per year.[3] At currently projected rates of increase, by the year 2000 the population will be 1.4 billion.

China's large population is a problem because of limited land resources, but it also means a larger labor force. More than one crop per year has to be planted, but the labor is available to harvest one crop and plant another in a very short time, to cultivate the crops and to collect the huge amounts of organic fertilizer necessary to replace the nutrients taken from the soil.

The attitude of the Chinese toward their population seems ambiguous and has changed from time to time. It is because of their dense population that they have had to adopt such an intensive farming system and that they have been able to maintain only a narrow margin over subsistence despite their intensive use of the land. Because they recognize the problems it creates, the Chinese since the founding of the People's Republic have attempted with varying degrees of vigor and success to control their rate of population growth.

The Chinese have begun to achieve some success in controlling their population growth rate. Before contemporary times, the traditional Malthusian checks of famine and war had prevented the population from growing much more rapidly than agricultural production. Nevertheless, with the development of intensive agricultural methods, most of the country had become very densely populated by 1949 and the population continued to grow during the 1950's. After several false starts, the Chinese have become committed to population planning.

Population planning measures seem to have been effective, especially in the cities. They are carried out mainly through strong organization, peer pressure, late marriages, and a broad education program to control the number and timing of births. As a last resort, in some areas even stronger measures, such as denial of food ration cards for more than two children, are employed. Contraceptive supplies and abortions are provided by the state. As a result, the trend of the rate of population increases is declining.

The goal of the leadership is to reduce the population growth rate to less than one percent. Hua Kuo-feng announced at the Fifth National People's Congress that this goal is to be achieved by 1980.[4] In reality, it is likely to take longer, but the leadership clearly intends to make strenuous efforts to continue to lower the population growth rate.

III. AGRICULTURAL POLICY

A. The Background of Policy

Chinese agricultural development policies have been strongly influenced by the pattern of development which had occurred before 1949. In modernizing the Chinese have looked to the experience of their own past and to the experiences of other countries with similar problems and goals. Most notably, they have profited from the experiences of the Soviet Union and Japan.

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[3] See Aird, John S., "Population Growth in the People's Republic of China," tables 1 and 2, pp. 465 and 467 in this volume.

[4] See *FBIS* Mar. 7, 1978, p. D25.

Japan shares with China the characteristics of dense population and intensive traditional agriculture, as well as a similar cultural heritage. And the Japanese had succeeded in modernizing their agriculture and raising yields to extremely high levels while simultaneously achieving very high industrial growth rates. The Chinese press in discussion of agricultural policy during the early 1960's often made reference to Japan's intensive use of modern inputs. Development has taken place in a different economic setting, but the path to agricultural modernization chosen by the Chinese, and the major factors of production used in the process, are strikingly similar to those of Japan.

During most of the 1950's, however, Chinese agricultural policy seems to have taken its lessons from the Soviet model. Although the two countries' agricultural systems are physically very different, China shared with the Soviet Union, among other things, basically similar ideology and the specific goal of rapid industrialization supported by a collectivized agriculture.

Chinese policies toward agriculture in the 1950's have sometimes been compared to those undertaken by the Soviets under Stalin. While the Chinese deny that the policies they followed were like those of the Soviets, there were in fact some important similarities. Investment in agriculture, and the provision of modern inputs, were relatively small. Agriculture got only 7.6 percent of Chinese investment funds during the first 5-year plan (1953–57), or an average of 838 million yuan per year.[5] And also, like the Soviets, the ultimate goal of the Chinese was collectivization and the use of agriculture to support industrialization.

On the other hand, collectivization in China proceeded in stages and (even considering the Great Leap Forward) was achieved with less turmoil than in the Soviet Union. The burden of taxation and compulsory procurement of grain was lighter in China than it had been in the Soviet Union. The amount of labor which moved from rural to urban areas was also smaller in China. The Chinese apparently learned some lessons from the example of the Soviet collectivization experience.

B. Policy in the 1950's

China's policies toward agriculture since 1949 have gone through several distinct phases.[6] The earliest stage, lasting through 1952, was recovery from the years of war and civil war. This was followed during the first 5-year plan period by collectivization in several stages, leading to the formation of communes in most agricultural areas in 1958.

In 1956 the National Program for Agricultural Development (NPAD) was adopted. The NPAD was to run from 1956 through 1967, and included many ambitious goals for the rural sector. Among the most important were the goals for grain output. The main agricultural areas north of the Yellow River were to attain by 1967 annual grain yields of 3 tons per hectare; between the Yellow River and the Huai River 3.75 tons per hectare; and south of the Huai River 6 tons per hectare.

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[5] State Statistical Bureau. *Ten Great Years*, p. 57. Peking: 1960. Most of this was in water conservancy.

[6] Policy during the 1950's is described in Schran, Peter, *The Development of Chinese Agriculture 1950–59*. Urbana: University of Illinois Press, 1969. Some aspects of Chinese policy since that time are discussed in Stavis, Benedict, *Making Green Revolution*. Ithaca: Cornell University Rural Development Committee, 1974. An overview of agriclutural policy and its relationship to other policies and problems is provided in Eckstein, Alexander, *China's Economic Revolution*. Cambridge University Press, 1977.

During all of the 1950's the government's agricultural development programs were designed basically to continue the intensification of traditional agriculture. Provision of modern inputs was kept at low levels in the expectation that more effective use of traditional means alone would be enough to raise yields. Agriculture received relatively little investment, as emphasis was put on building industry. Nevertheless, agricultural production grew quite steadily, and per capita grain production by 1957 and 1958 was high by the standards of Chinese history.

Encouraged by their apparent success, the Chinese embarked in 1958 upon the Great Leap Forward. In agriculture, this program sidelined the NPAD and set even more ambitious—but virtually unreachable—production targets. It called for complete collectivization of nearly all production and consumption in the communes. High pressure for the attainment of the goals of the leap and the rapid changes in organization led to a near breakdown of the system of control, including the statistical network. The turmoil of the Great Leap Forward, combined with bad weather, resulted in 3 successive years of disastrous harvests in 1959–61. Livestock were slaughtered, agricultural output fell drastically, and the level of nutrition approached starvation in some areas. After having been net exporters of grain throughout the 1950's, the Chinese became net importers of grain due to large purchases. The overall level of economic activity in the country declined sharply.

C. *Agriculture First*

Given this grave situation, at the beginning of the 1960s the Chinese had little choice but to reorient their priorities toward agriculture. The alternative was continuing agricultural crisis, with serious repercussions for the rest of the economy and for the nation's stability. The Chinese urgently needed to promote agricultural recovery and then to assure continued growth in output to keep pace with population growth and to prevent repetition of the 1959–61 disasters. With minor changes, the NPAD goals were again adopted.

Beginning in 1962, and continuing to the present day, the Chinese have followed a policy of "putting agriculture first," meaning essentially recognition of the primary importance of agriculture in the economy. The practical result of this has been increased investment in agriculture and steady expansion of the supply of modern inputs to agricultural producers.

Policy toward the supply of modern inputs has alternated between emphasis on importing foreign plants and products and providing them indigenously. At the same time emphasis has fluctuated between large plant production and rural, small-plant production. A good example is the fertilizer industry.

During the midsixties large foreign fertilizer plants were imported to serve as models for the domestic heavy machinery manufacturing industry. Some success was achieved in producing a serialized medium-size urea plant. However, during the Cultural Revolution development policy favored small chemical fertilizer plants, and hundreds were built throughout the country while the large plant program was sharply cut back. After the poor harvest of 1972 the Chinese leadership decided that the domestic programs were still not supplying enough fertilizer and in a more moderate political climate purchased 13 of the world's largest, most technically advanced ammonia-urea complexes. The present aim is to achieve self-reliance but to continue to "let foreign things serve China."

The agriculture first policy was implemented through several specific programs, including most importantly the policy of building up areas of high and stable yield and favoring them with the greatest supplies of modern inputs. As the name implies, these high and stable yielding areas are basically areas where unit yields were comparatively high and where irrigation and drainage were adequate to reduce fluctuations in yields due to weather conditions. Since irrigation is an important complement to the use of new seeds and fertilizer, these areas were best able to make use of the new food production technology; and since yields, procurement, and incomes were higher in these areas, they could also better afford to purchase fertilizer and other inputs and to bear whatever risks were associated with their use.[7] These high and stable yielding areas were to be a major source of state procurement of grain and other crops. Areas to be selected were those which could give the highest and quickest payoff for the least capital. Areas which were not high and stable yielding and were not therefore given preferential treatment in investment were encouraged to build themselves up self-reliantly.

During most of the 1960's, emphasis on these areas meant that the rice region in the South received preferential treatment. Both to promote recovery from the 1959–61 agricultural disasters, and because the rice region had the greatest expanse of land which was already high and stable yielding, it received a disproportionate share of the new modern inputs. The largest proportion of the greatly increased amounts of chemical fertilizer supplied during the decade went to the South, and new rice seeds were planted over a wide area. By the end of the decade, however, most of the readily achievable gains in the region had been obtained. Grain output had grown rapidly south of the Yangtze during the 1960's, while in the North yields remained low. Since the late 1960's, irrigation has been steadily expanded and the area of high and stable yields which can make good use of new inputs has grown in the northern wheat region. This has promoted the achievement of self-sufficiency in grain production by several provinces in the wheat region.

Tachai, originally a poor production brigade in remote Hsi-yang County, Shensi Province, in 1964 was designated the national model for Chinese agricultural development. It had by then already made remarkable progress on its own in developing its agricultural base. Although located north of the Huai River, Tachai had surpassed the NPAD grain yield target for areas south of the Huai River. Tachai has become a wealthy brigade by Chinese standards mainly by improving its land and soil, and through using more fertilizer and improved seeds. Thousands of people visit Tachai each year to see the accomplishments of this brigade.

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[7] See Yang-po, "Construction of High-Yield Farmland," in *Ta kung pao*, Peking, May 1, 1964; translated in JPRS, No. 25060, June 12, 1964, pp. 5-10. (JEC 72, p. 132)

"In Agriculture Learn from Tachai" has been used to promote various aims at different times. It began as a campaign to "put politics in command", and to promote "self-reliance" and "bitter struggle." In short, farmers were told not to rely on state aid but to put in extra, unremunerated labor to raise land productivity themselves. This included making some provision for cadre and administrative personnel to take part in manual labor. In the midseventies it was focused on farmland capital construction which became a major work activity for peasants during the slack season (winter-spring).

In October 1975, the First National Conference To Learn from Tachai was held to examine the experience gained from the Tachai movement. Out of the conference came a more concrete set of goals for the Tachai campaign. The county was fixed as the key administrative unit for achievement of the goals. In December 1976 the Second National Conference in Learning from Tachai was held basically to reaffirm the goals of the first conference in light of the political disruption of the intervening year.

As counties reach certain standards they are designated Tachai-type counties. The criteria are somewhat flexible in practice but the following standards were given at the 1975 conference: [8]

> The county party committee should be a leading core which firmly adheres to the party's line and policies and is united in struggle.
>
> It should establish the dominance of the poor and lower-middle peasants as a class so as to be able to wage resolute struggles against capitalist activities and exercise effective supervision over the class enemies and remold them.
>
> Cadres at the county, commune, and brigade levels should, like those in Hsiyang, regularly participate in collective production labor.
>
> Rapid progress and substantial results should be achieved in farmland capital construction, mechanization of agriculture and scientific farming.
>
> The collective economy should be steadily expanded and production and income of the poor communes and brigades should reach or surpass the present level of the average communes and brigades in the locality.
>
> All-round development should be made in agriculture, forestry, animal husbandry, side occupations, and fishery, with considerable increases in output, big contributions to the state and steady improvement in the living standards of the commune members.

The six criteria are a mixture of political, social, and economic goals aimed at advancing the rural sector, particularly the poorer areas, economically, and at the same time strengthening political control over the local producing units. It is hoped that the area which is high and stable yielding can be pushed far into the northern part of the country. By the end of 1975, 317 of the country's more than 2,000 counties had reached Tachai status. Hua Kuo-feng, in his conference speech, called for one third of all China's counties to become Tachai-type by 1980, and for basic mechanization of agriculture by the same year.

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[8] Peking Review, No. 44, Oct. 31, 1975.

D. Related Policies

In addition to their overall agricultural development policies, the Chinese have pursued a number of programs aimed at specific goals. These include programs concerned with state procurement, private plots and free markets, prices, and grain storage and reserves.

One of the constant aims of the state's agricultural policy since the early fifties has been to assure reliable procurement of needed agricultural commodities. These are obtained through taxes, through sales under quotas imposed on each producing unit, and through above-quota sales at higher prices by more productive units. In part to encourage higher production, taxes and quotas are fixed for each unit for a period of years, and are not increased during the period. Over time, as production has increased and as the government has come to rely on imports, the burden of taxes has declined from about 12 percent of total output in the early fifties to about 5 percent now.[9]

Peasants are also allowed to raise agricultural products on private plots and to sell them on their own account. There are free markets in many rural and urban areas, and there are enterprising individuals who perform the service of providing these markets with agricultural commodities for sale. Government policy toward this limited private activity in the agricultural sector has fluctuated, with more "radical" officials generally favoring stricter controls on it. It has served the function of supplementing the supply of some important agricultural products and of regulating the pressure of consumer demands.

Prices paid producers for most agricultural commodities have been raised over time, also encouraging greater production. The procurement prices of most kinds of grain, for example, have been raised nearly to the urban retail level, meaning the state subsidizes transport and other costs of providing the cities with food. And prices in the important free market have increased even more, reflecting excess demand. Prices of agricultural producer goods such as fertilizer, on the other hand, have been reduced. In other words, the Chinese have done just the opposite of what the Soviets did during the "scissors crisis" of the 1920's. They have thus maintained the incentives necessary to get peasants to use more modern inputs, to increase their production of commodities, and to increase procurement.

The Chinese have attempted to promote grain storage and maintenance of food reserves. These provide carryover stocks for the winter after each harvest, and to some extent also serve as a buffer for poor harvests and for defense purposes. State reserves are held at the commune level and higher, with local supplies maintained by villages and individuals. Storage facilities are often crude and include caves and bins made of mud and straw.[10] Estimates of the total amount held in storage differ, perhaps depending on whether state reserves or total reserves are counted, or on the season or harvest conditions; they range from 14 million to 40 million or more tons. But even 40 million tons would not be enough in the unlikely event of a serious, prolonged food availability crisis.

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[9] See FBIS, Nov. 30, 1977, p. E12.

[10] BBC, FE/W956/A/1, Nov. 23, 1977.

E. Planning and Organization

Agricultural production in China is planned and organized by the state, as are most economic activities. The Ministry of Agriculture and Forestry is responsible for agricultural programs. It was founded in 1970 by the merger of four ministries: Agriculture, Forestry, Marine Products, and Land Reclamation and State Farms.

Counties, the lowest state level of organization, bear a great deal of responsibility for coordinating and implementing agricultural plans. There are about 2,000 counties in China, and each one on average administers the use of about 50,000 hectares (or 120,000 acres) of farmland. County governments often run their own fertilizer factories, or other small-scale factories, manufacturing agricultural inputs for local use. They decide on the allocation of these inputs, as well as of those purchased from the state, and plan the procurement and disposition of output. They do all of this in accordance with the plans of the higher state levels to which they are subordinate, including prefectures, provinces, and the national ministry. They also coordinate their planning with the collective sector below them, including the communes within their jurisdiction.

There are about 50,000 rural communes in China, each with an average of more than 15,000 inhabitants. The communes are the highest level of collective organization in China. In the collective sector most factors of production are owned jointly by the members of the collective unit rather than by the state. The land, for example, is mostly owned by small groups of about 30 households called production teams. These teams are the basic accounting units in Chinese agriculture, and they take care of day-to-day farm management. Their incomes depend on how much they produce. The several teams in each village together form a production brigade, and several brigades form a commune.

The production teams divide their collective incomes—the proceeds of the sale of crops and other products, less the cost of inputs such as seed, fertilizer, and farm tools, as well as funds for investment—among the members on the basis of the number of work points each has accumulated during the year. A healthy male can usually earn 10 points for a full day's work, with somewhat fewer points going to those who can do less heavy work. Those with a "bad class background" or the "wrong political viewpoint" may also receive fewer points. In addition, peasants earn income privately by growing vegetables, pigs or poultry on their private plots (limited to about 5 percent of the land), or by supplying other goods or services on the free markets.

At present, as part of the Tachai campaign the leadership appears to be moving the basic accounting unit where possible up to the brigade level. Article 7 of the new constitution (adopted at the Fifth National People's Congress) states that the production team is the basic accounting unit, but that "A production brigade may become the basic accounting unit when its conditions are ripe." For example in 1977, 698 brigades (5.7 percent of the total) in Kirin had been made the basic accounting unit.[11] Raising the basic unit to cover a wider area in effect advances collectivization. It helps promote the accumulation of funds to invest in machinery and large-scale rural improvement projects. It also moves economic and political control closer to the central government.

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[11] FBIS, Feb. 23, 1978, p. L3.

Expanding the basic unit also has the effect of leveling income disparities within villages. The egalitarian goal of raising lower rural incomes has been a consistent aspect of the Tachai campaign. This sometimes conflicts with the goal of raising production and procurement, which depends in part on an effective system of incentives.

Although the basic accounting unit is being raised, the tending of private plots by households will continue to play an important role for the foreseeable future. Private plots are guaranteed in the constitution and serve an important role in the economy by providing most of the poultry, pigs, and vegetables consumed in China.

These sideline occupations are an important source of income for Chinese peasants. From the point of view of the state, while these activities do not have a central place in agricultural production, they are a practical way of obtaining the intensive use of peasant labor for the production of some high-value items.

One additional form of agricultural organization is the state farm. Many of these were formed during the 1950's as part of the land reclamation drive. There are about 2,000 of them today.[12] They are owned and operated by the state, and their organization and operation in some respects is similar to that of a factory. Workers on these farms are paid regular wages, and their incomes do not depend on how much the farm produces. They are generally less efficient than the collective sector. State farms occupy about 4 million hectares, or less than 5 percent of China's cultivated land.[13] Located most often in frontier areas, they are rather rare in the main agricultural regions.

F. Results

The results of China's agricultural policies, from one point of view, have been impressive. China has increased its total grain output from 111 million tons in 1949 (or 161 million tons in 1952, when recovery was basically completed) to 285 million tons in 1977. Over most periods, except for the crisis years of 1959–61, grain production on average has increased by more than 3 percent per year, well above the rate of population growth and a high rate of growth by the historical standards of China and other countries.[14] Grain production has continued to increase regularly since the early 1960's as the Government has emphasized agricultural development. The last two harvest years have been disappointing for the Chinese, but more new inputs are continuing to come onstream, and normal weather in 1978 could result in an exceptional increase in grain output.

Yet the Chinese have still not broken out of the range of subsistence-level production. They have been net importers of grain year in and year out since the early 1960's, and per capita production has only regained the levels of the late 1950's in the last several years. This does not leave much of a margin above subsistence. And output in most of China is still very vulnerable to fluctuations in the weather. There is room for considerable improvement, then, in the degree of predictability and safety of the harvest, as well as in the quantity produced to meet higher potential consumer demand and raise living standards.

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[12] BBC FE/W967/A/2, Feb. 15, 1978.

[13] Ibid.

[14] The long-term rate of growth of grain output in 1952–77, calculated from a logarithmic regression, was 2.3 percent annually.

The technological transformation of agriculture which has begun in China still has far to go. Many areas have adopted modern production methods on a large scale, and their yields have increased dramatically. There are probably few areas which have been completely untouched by the push for agricultural modernization. But in most areas, modernization has not proceeded very far, and it remains a potential rather than an actual accomplishment.

Since the state explicitly set out in the early 1960's to favor the more productive areas, it is not surprising that differences in the levels of use of modern inputs, in output, and in incomes are very pronounced in the countryside. This is not new, of course—income distribution was unequal in traditional Chinese agriculture, and it is so in most developing countries today. But agricultural development policy has not apparently resulted in a very egalitarian income distribution, at least not among areas.

The productivity and income differences among various parts of the wheatgrowing North China Plain are clear to visitors, for example. Some communes have all their land irrigated by power pumps, while others have no irrigation facilities at all and have to carry water to the fields in buckets. Some counties have several small fertilizer plants and get more than their share of imported urea; others have no plants and cannot afford to buy more than small quantities of fertilizer. Yields and output naturally vary widely under these conditions, and peasants' incomes sometimes are very unequal.

The shape and direction of future Chinese policies designed to deal with these continuing problems are beginning to appear. The new leadership gives every indication that it will continue to push for modernization through the 1980's. It is clear that the Chinese intend to continue to build and expand areas of high and stable yield. There will be continued increases in investment in agriculture, multiple cropping, and the supply of modern inputs such as chemical fertilizer. The Chinese are increasingly emphasizing mechanization, to promote more rational use of labor. And renewed attention is being given to expanding cultivated area where possible, particularly in the Northeast. Heilungkiang has the greatest amount of reclaimable wasteland in China; and in 1978, 330,000 hectares of new land will be plowed.[15]

IV. Agricultural Output

A. Grain Crops

Grain production in 1977 was officially claimed to have remained at the 1976 level, and including soybeans is estimated at 285 million tons. (See appendix for grain series and per capita grain availabilities.) It was the second consecutive year of no significant growth in grain output. Bad weather was the fundamental cause for the leveling off in grain production since 1975. A drought that extended from October

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[15] FBIS, Mar. 6, 1978, p. D4.

1976 to April 1977 was the major problem affecting production in 1977. The winter wheat crop, which includes some winter barley, declined by an estimated 10 percent, or about 4 to 5 million tons, because of the dry weather. An abnormally high amount of waterlogging and cool temperatures after the drought had broken caused additional crop losses in the summer and fall. The 1977 fall harvest was nevertheless much improved over 1976. In 1976 the pattern differed. After a record winter wheat crop, early crops were retarded by cool, damp weather which in turn delayed planting of the fall-harvested crops. An early winter and excess precipitation then caused harvest losses.

Weather is the biggest determinant of annual fluctuations in the harvest. The decade of the 1950's was mostly a period of good weather, and it was not until the three bad weather years of 1959–61 that China's ability to provide an adequate amount of grain on the basis of traditional technology was seriously challenged. The challenge was not met, and agricultural policy changed. Since the early 1960's, the Chinese leadership has stressed measures that would limit the damage caused by bad weather.

There has been bad weather since 1961, most notably in 1972, and 1976–77, but grain production has suffered nothing like the reverses following the Great Leap Forward. (See fig. 2. The decline in grain output in 1968 was caused mainly by a return to normal weather following an exceptionally good year in 1967.) The drought in 1977, for example, which the Chinese press called the worst in the history of the PRC, would have been a disaster had it occurred during the early 1960's. Technical modernization and the greater provision of agricultural inputs have made China somewhat less subject to natural adversities, but per capita production of grain has only recently regained the level of the late 1950's, leaving China still producing at subsistence levels.

B. Industrial Crops

The cotton harvest in 1977 probably declined from that of 1976 but reporting since the yearend statement has been ambiguous.[16] Ginned cotton output is estimated at 2.0 million tons, somewhat below the 1973 record of 2.5 million tons. (See appendix for cotton series.) Cotton output since 1965 has grown very little, and since 1973 has leveled off. Synthetic fibers are increasingly being substituted for cotton. An estimated 100,000 tons of man-made fibers were produced in 1970, and by 1980 China will be producing one-half million tons per year.[17] Rapid growth of synthetics has been made possible by the purchase of turnkey petrochemical plants and by the growth in petroleum supply.

The primary oil seed crops in China are peanuts, rapeseed, and sesame. Oil is also extracted from cottonseed and soybeans, but these are not counted as oilseeds in Chinese production statistics. The following tabulation shows current estimated levels of oil bearing seeds other than soybeans:[18]

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[16] Peking Review, No. 2, Jan. 13, 1978, p. 12.

[17] FBIS, Nov. 23, 1976, p. E11.

[18] Rapeseed output in 1975 increased 50 percent over 1970 (FBIS, Nov. 24, 1975, p. E3). Rapeseed output in 1970 is estimated at 1 million tons, or about the 1958 reported level. In 1975 rapeseed accounted for one-third of the oilseed crop leaving 3 million tons primarily for peanuts and sesame, almost no change over the late 1950's. (FBIS, Aug. 13, 1975, p. E4) Cottonseed is calculated from the estimated output of ginned cotton. Cottonseed weight is twice the weight of ginned cotton. (JMJP, Feb. 11, 1957, p. 3). See appendix for cotton series.

	Thousand tons
Rapeseed	1,500
Peanuts	2,700
Sesame	300
Cottonseed	4,800

Rapeseed has been the only type of oilseed to achieve significant growth in production since the 1950's.

Production of sugar, particularly from sugarcane, was probably down in 1977. Water that could have spared the sugarcane stress from the drought in Kwangtung was mostly used on grain crops. Sugar production appears to have leveled off since 1973 when a record was claimed.

China produces more tobacco than any other country in the world. Acreage is about 500,000 hectares, more than is planted in the United States. Yields are high by world standards: an average of 3.4 tons per hectare. Tobacco is important both as a domestic consumer product and as an earner of foreign exchange.

C. Livestock and Other Products

Livestock make up an important part of the value of agricultural production in China. They are a major source of animal protein and fat in the Chinese diet, and a source of income to those who raise them. (See appendix for figures on production of livestock.) Their value to Chinese farmers, however, lies not only in the value of animal products sold and consumed, such as meat and bristles, but also in the draft power and organic fertilizer that livestock provide for the production of crops. Because of the heavy use of organic fertilizer in China, the relationship between livestock breeding and crop production is strong and direct. In fact, it has been argued that if livestock were raised only for the value of their directly consumable products, they would hardly be raised at all in China.[19]

The Government has varied its policy from time to time on the questions of whether hogs should be raised privately or collectively, and the amount of emphasis that should be given livestock production. And agricultural production conditions have influenced livestock raising as well. The numbers of livestock raised, therefore, have fluctuated from year to year, sometimes very sharply.[20]

The major categories of livestock in China include hogs, poultry, large-draft animals, and sheep and goats. Hogs and poultry are the most important meat producers. Sheep and goats are mostly grown outside the main agricultural areas. There are now about 280 million hogs, just under 100 million draft animals, and about 160 million sheep and goats in China. Hogs have been the fastest growing segment of the livestock population since the early 1960's. Their breeding cycle is shorter than that of large animals, so that increases can be achieved more quickly.

During the 1950's the number of hogs in stock fluctuated depending on Government policy toward private hog raising and toward procurement. Toward the end of the period, in 1957 and 1958, their numbers increased sharply. With the drive to organize agricultural producers into communes, and the disorganization and lack of incentives that characterized the Great Leap, however, the number of livestock began to fall.

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[19] See, e.g., Scott, James Cameron, *Health and Agriculture in China*, pp. 139–40. London: Faber and Faber Ltd., 1952. Also see Perkins, Dwight H., op. cit., pp. 71–73.

[20] See Walker, Kenneth, *Planning in Chinese Agriculture*, London: Frank Cass, 1965.

The decline in hog production during the agricultural crisis of 1959–61 was immense. The precise size of the decline is not known, but large numbers of hogs and other livestock were slaughtered, exports declined drastically, and rebuilding of herds in the early 1960's was strongly emphasized in the press.[21] The Government's reemphasis on hog-raising succeeded, and by the end of 1964 the number of hogs surpassed the previous record.[22]

By 1965 recovery was complete, and the number of hogs was so great that the state storage facilities could not handle the volume of commerce in pork.[23] During the remainder of the 1960's and the early 1970's hog production increased substantially. Figures released since 1972, however, suggest that recent increases have been smaller. This slow growth seems plausible in view of the rather sluggish performance of grain output in the major hog-producing provinces of the south.

While the number of hogs reportedly surpassed their previous peak by the end of 1964, it was not claimed that large animals had recovered until 1967. Growth in the draft animal herd has continued to be slow since the 1960's. Draft animals compete for grain with humans and with smaller animals such as pigs. Their products are generally not consumed directly in China; they are used for draft power, not food. And their breeding cycle is longer. When grain production declined in 1959–61, therefore, the number of draft animals declined even more sharply and recovered rather slowly.

The fact that the number of large animals declined more sharply than the number of hogs, and recovered more slowly, may also be explained in part by the relatively large number of hogs in the southern provinces and the more even distribution of large animals across all of China's agricultural areas. Since agricultural output recovered more rapidly in the south during the 1960's, more resources may have been available there for rebuilding herds, so that the numbers of hogs might have grown relatively more rapidly. As more heavy tasks are mechanized in the future and the need for draft power tapers off, the population of draft animals is likely to grow slowly if at all.

Poultry, an important source of meat, consists almost entirely of chickens and ducks. No national statistics are available, probably because most poultry are raised and slaughtered privately, both in rural and urban areas. The current mechanization campaign includes chicken raising, and large-scale farms are being built in at least a few large muncipalities. For example, in Peking a chicken farm capable of hatching 6 million birds a year and raising 200,000 egg-laying hens a year was recently built.[24]

Fishing provides some protein and variety in Chinese diets, as well as export products. Fish are caught naturally in the oceans and rivers, and are also raised in ponds and rice paddies. The fisheries sector has apparently received relatively little attention, but output has increased at a slightly faster pace than grain output.[25]

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[21] The decline was particularly massive in the spring of 1960. See "China News Analysis," No. 341, October 14, 1960, p. 6.
[22] See "Peking Review," No. 29, July 16, 1965 p. 20.
[23] See "China News Analysis," No. 778, October 17, 1969, p. 1.
[24] *FBIS*, February 15, 1978, p. E12.

The Chinese have made some progress in forestry work and afforestation but their efforts have not been as successful as some other labor-intensive Chinese agricultural programs such as farmland capital construction. Trees had been harvested for centuries in the more densely populated parts of China, so that by the present century many areas were totally denuded. Current efforts focus mainly on planting trees to control soil erosion, as windbreaks, and to a lesser extent as timber reserves.[26]

V. FACTORS OF PRODUCTION AND TECHNOLOGICAL MODERNIZATION

All of the basic inputs that the Chinese peasants had at their command in the traditional economy were brought together in an admirably efficient system that usually used China's limited agricultural resources to excellent advantage. The Chinese continue to rely very heavily on the components of East Asian peasant agriculture, such as use of organic fertilizer. Even in areas where agriculture is now being modernized, the means that have been used for this purpose in the last 15 years are basically the same ones that have always been used. Fertilizer, irrigation, improved seeds, multiple cropping—all of these have long been part of the package of inputs and methods used by Chinese peasants. The inputs now include more modern technology—chemical fertilizer is applied in addition to organic, and irrigation ditches are lined with concrete—but the means themselves are unchanged.

Since the institution of the "agriculture first" policy the rate of increase in use and modernization of inputs has accelerated. The changes in use of the key inputs of the "green revolution" food production technology have been particularly marked. In this section we shall examine the various major inputs the Chinese use in agricultural production, the development of their use over time, their results, and continuing problems.

A. Land Use and Chopping Patterns

1. GRAIN CROPS

Rice is by far China's most important and popular grain. It accounts for just under half of all grains produced—130 million tons in 1977—and accounts for much more than one-half of all grains consumed directly as food. Rice is grown in every province but Tsinghai. Since 1949 the sown area of rice has increased 40 percent overall, and 100 percent in the north.[27] Increased irrigation and the development of early-ripening, cold-tolerant rice strains have made possible the extension of rice cultivation to the North. The share of rice in all grains produced in China has remained at just under one half since 1949. Table 1 gives estimated production, sown area, and yield of the seasonal rice crops.

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[25] See SCMP, No. 5087, p. 79; and Solecki, Jan. J., *Economic Aspects of the Fishing Industry in Mainland China*. Vancouver: Institute of Fisheries, the University of British Columbia, 1966.

[26] See Richardson, S. D., *Forestry in Communist China*. Baltimore: Johns Hopkins Press, 1960. Also see CIA, "People's Republic of China: Timber Production and End Uses," ER76-10493. Washington: Library of Congress, 1976.

[27] FBIS, Sept. 29, 1977, p. E1.

Wheat is the second most important grain in China. Production in 1976 was 41 million tons.[28] In 1972 sown area of wheat was 20 percent of the total area sown to grain,[29] a slight decrease in relative share of acreage since the early 1950's. Nevertheless, because of increasing unit yields, the wheat share of all grains produced has increased from about 12 percent during the 1950s to about 15 percent in recent years.

TABLE 1.—CHINA: ESTIMATED SEASONAL RICE CROP STATISTICS FOR 1976

	Production (million tons)	Sown area (million hectares)	Yield (tons per hectare)
Early rice	[1] 50	[2] 13	3.85
Late rice	[3] 35	[4] 13	2.69
Single rice [5]	41	10	4.10
Total rice [6]	126	36	3.50

[1] One-third of total grain comes from the early harvest, (NCNA, Aug. 16, 1975) but in 1976 the share was larger because of record winter wheat output. Early harvest is estimated at 100,000,000 tons, minus 50,000,000 tons for winter wheat and barley equals 50,000,000 tons for early rice.

[2] FBIS, 18, Aug. 18, 1977, p. E7.

[3] "If yield were the same as early rice, late rice would increase 15,000,000 tons." (FBIS, Dec. 9, 1977, p. E13). Since sown areas are approximately equal, late rice production is 35,000,000 tons.

[4] "Areas of early and late rice are about the same" JMJP, July 18, 1977, p. 1.

[5] Residual.

[6] Total rice increased 1.58 times over 1949 (FBIS, Sept. 29, 1977, p. E1). Rice output in 1949 equaled 48,650,000 tons, times 2.58 equals 125,520,000 tons (rounded to 126). Average per hectare yield increased from 1.87 to 3.5 tons.

Barley is sometimes included in Chinese wheat statistics because as a winter crop it is to a certain extent interchangeable with wheat. The Chinese call wheat, barley, and naked barley the "three wheats." In the lower Yangtse River Valley barley is often grown instead of wheat because its earlier maturity makes it easier to triple crop. Total output of barley is probably around 5 million tons.

Corn follows wheat in importance, but the Chinese have said little about absolute production levels. The national sown area in 1971 was 13.6 million hectares.[30] Though the growth potential for corn yields is greater than for wheat, it is estimated that corn yields have only grown at about the same rate as wheat yields, and that present corn output is in the range of 30 million to 35 million tons. Sorghum is grown under the same conditions as corn, and acreage sown to sorghum probably has been reduced as corn acreage has been expanded. The national figure for sown area of sorghum was given in 1971 as 7.6 million hectares.[31] Based upon sown area, sorghum production may be 15 million to 20 million tons. No recent national figures are available on millet, the other important coarse grain besides corn and sorghum.

China continues to plant large areas to potatoes and pulses, but no recent national statistics are available. These crops are often planted as catch crops, and production varies depending upon how well the other crops fare. Potatoes are now counted as grain in the ratio of 5:1 (five tons of potatoes equals one ton of grain), instead of the 1950's ratio of 4:1. The earliest available evidence of the change is from 1970.[32]

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[28] Field, Robert Michael, and James A. Kilpatrick, "Chinese Grain Production: An Interpretation of the Data" (table 2). The China Quarterly, forthcoming.

[29] FBIS, Jan. 30, 1973, p. B5.

[30] BBC, FE/W647/A/8, November 10, 1971.

[31] Ibid.

[32] Field, Robert Michael, and James A. Kilpatrick, op. cit.

Soybeans have a long history in China, but their relative share in the food supply is diminishing. Total national output of soybeans has not been revealed by the Chinese since the 1950's. Production is presently estimated at about 10 million tons, the same as 20 years ago. Soybeans are usually included in China's numerical claims for total grain output, rather than counted as an oilseed.

Soybean yields have increased somewhat over time, but sown area has decreased because higher yielding grain such as corn has been substituted. Most of the shift out of soybean acreage has been from the North China Plain. Anhwei, Kiangsu, Honan, and Shantung, which in 1957 produced more than 40 percent of the total soybean crop, now produce 20 percent or less. In the 1950's only one-third of China's soybean output came from the northeast; now probably 50 to 60 percent is grown there.

Travelers to China in recent years report that soybeans are seen growing on all types of marginal land—along roadways, creek banks, and in out-of-the-way places. The impression received is that production teams are trying to raise soybeans for local consumption without interfering too much with the higher yielding, income-earning grain crops.

2. INDUSTRIAL CROPS

Although synthetic fibers now have a firm base for future growth, a rapid switching of cotton acreage is unlikely. The world market value of the cotton grown on a hectare of land in China on average is higher than that of the grain that could be grown on the same amount of land. Since China imports both grain and cotton, the economic incentive to grow cotton has not diminished. The main benefit to agriculture from the increase in synthetic fiber output is that it greatly reduces pressure to put even more land and other resources into cotton production. Agricultural planners can concentrate on food crops, which are foremost in importance in achieving China's goal of self-sufficiency.

Oilseeds have received lower priority for development than grain. Rapeseed has done well mainly because it is a winter crop and has fit well into the expanded triple cropping scheme in south and central China. Because of its hardiness and maturation time rapeseed is now also cultivated in north China on land once left fallowing during the winter or spring. By 1975 sown area of rapeseed had increased 60 percent over 1970; output was up 50 percent and accounted for one-third of total oilseed output.[33]

3. MULTIPLE CROPPING

The Chinese of necessity have developed multiple cropping to a very high degree. They lead the world in its development, often harvesting two food crops and sometimes three during the year from land that in another country might only yield a single crop. This is done by starting crops (usually rice) in seedbeds, and then transplanting them as soon as the land is ready, either following the cold weather or an earlier harvest. Following this practice China presently sows an extimated 150 million to 160 million hectares of crops each year on its 100 million hectares of arable farmland.

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[33] Peking Review, No. 38, September 19, 1975, p. 30.

Increased multiple cropping accounted for 40 percent of the increase in total annual rice output between 1949 and 1975 in China.[34] The major trends in the pattern of multiple cropping have been expansion of rice production (summer crop) northward and wheat production (winter crop) southward. Winter wheat in central and south China has been competing with winter barley and winter rapeseed.

Another significant trend has been the growing importance of corn as a summer crop in the north, and as an early or late crop in the south. Much of the increase in sowing of corn has come at the expense of such traditional crops as soybeans and sorghum.

4. INTERCROPPING

Intercropping, the practice of growing more than one crop at the same time on the same piece of land in alternate rows, is more prevalent in the north because the south's widespread paddy rice fields cannot be intercropped. In cotton regions wheat is often interplanted with cotton in a sequence which allows the harvesting of one while the other is too small to harm. Because of closer planting than otherwise possible, more cotton and wheat can be grown on 100 intercropped hectares than can be grown on 50 hectares of each. Other intercrop combinations in China are wheat-barley, wheat-corn, corn-soybeans, corn-millet, corn-sorghum, corn-peanuts, sorghum-millet, and sorghum-soybeans. Fruit trees are almost always intercropped. Wheat, soybeans or vegetables are the crops most commonly grown in orchards.

Intercropping is increasing, but is still mostly in the trial stage. Chinese farmers are experimenting from year to year to find the optimum combination of crops, planting distances and depths in their local areas. Pest control problems are sometimes compounded by intercropping, and new control measures have to be tested. Intercropping also makes mechanized planting and harvesting more complicated if not impossible.

B. Mechanization and Labor

In agricultural development, as in industrial development, machinery typically replaces or enhances human labor. Because it is a labor-abundant country, China benefits much more from the second kind of mechanization. Mechanization of agriculture in the Chinese context differs from farm mechanization in the West, because the tasks which regularly need to be done to maintain the high productivity of China's densely populated, intensively cultivated land are generally very different from those done in more extensive agricultural systems.

Mechanization has nonetheless fascinated the Chinese since the founding of the People's Republic, and continues to do so today. The subject has been controversial from time to time, and up to the present the level of mechanization in most places has remained rather low. Other inputs with a more direct effect in raising yields, such as fertilizer, have been given higher priority.

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[34] FBIS, May 13, 1975, p. E14.

Mao Tse-tung argued successfully during the 1950's that agriculture should be collectivized before being mechanized. But since collectivization, with abundant peasant labor available, development of the country's farm equipment industry has not been strongly emphasized. The industry has not received as much investment as some other agriculture-related industries, and the production of many important types of farm implements has been limited.

The Chinese leadership has now decided to give strong support to mechanization. The Third National Conference on Agricultural Mechanization, held in Peking in January 1978, proclaimed a number of ambitious goals and made it clear that mechanization is to become a central part of China's agricultural development program. The intermediate goal is "basic mechanization" of agriculture by 1980, the end of the current 5-year plan.

Only general definitions of "basic mechanization" were given at the conference. Yu Chiu-li said in a summation report[35] that by 1980 "70 percent of the major agricultural, forestry, animal husbandry, sideline production, and fishery operations should be mechanized." At the Fifth National People's Congress which concluded in March 1978, basic mechanization of agriculture was discussed further in conjunction with the new 10-year plan. By 1985 all major farm processes are to be 85 percent mechanized.

The tabulation below shows production increases planned by 1980 for various types of machinery. The decision has also been made to increase substantially the output of machinery for farmland capital construction, plant protection, transportation, harvesting, and farm-product processing.

	Percent
Large and medium tractors	70
Machine-drawn farm tools	110
Hand-guided tractors	36
Drainage and irrigation machines	32

Several obstacles lie in the way of rapid mechanization. One is simply the question of its appropriateness as a focus, given China's needs and the characteristics of the intensive agricultural system. Farmers will probably be reluctant to adapt to mechanization in many instances, especially where crop yields are already high. In addition, the economy will have difficulty supporting rapid growth of mechanization. Skilled labor to operate and repair machinery is almost certain to be a bottleneck, even though the Chinese plan to double the present number of skilled mechanics and operators. Iron, steel, and petroleum, all of which will be needed in increased quantities, have important competing uses in the economy.[36]

There are problems in fitting production of agricultural equipment to the precise tasks required—more plows, discs, drills, and small specialized equipment will be needed, and less emphasis on large tractors. Since 1965 tractor production has increased sevenfold but plowed acreage has only doubled.[37] Because the number of tractors has grown more rapidly than Chinese demand or ability to use them for plowing, and because of heavy demand for transport at peak seasons, they have been used increasingly for transport and other tasks. In Liaoning province, for example, the number of tractors in stock in 1977 was 10 times the 1965 figure. The proportion used for field work, however, declined from 74 percent to 54 percent.[38]

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[35] FBIS, Jan. 31, 1978, p. E6.

[36] See ibid. Planners hope to increase by 50 percent the amount of steel centrally allocated to produce agricultural machinery.

[37] Peking Review, No. 1, Jan. 3, 1975, p. 12.

The problems of manufacturing farm equipment were also addressed at the conference. Plans now call for more serial production of equipment. In recent years as the number of equipment manufacturers has increased throughout the country, so has the number of models of farm equipment. Quality control and standardization of parts have not been followed, and stockpiling and shortages have been problems.

In some areas the extent of mechanization has already surpassed the 1980 goal. In Shanghai, for example, 88 percent of the land is machine plowed.[39] In most places, though, the percentage is lower, and machinery, like other inputs, is distributed unevenly. In the highly productive rice-growing province of Szechwan only 10.9 percent of the cultivated land is machine plowed,[40] while in the relatively low-yield province of Heilungkiang, 45 percent of the field tasks and 60 percent of the nonfield work are done by machinery.[41]

The conferees urged the different agricultural regions to stress those aspects of mechanization appropriate to specific local conditions. In those places where the crop pattern and topography permit tractor plowing, such as the plain or delta regions, the Chinese will continue to level the land and consolidate fields. But it would be overly simple to measure the extent of mechanization solely by the area plowed by machinery. In many areas this is not possible, and there are other tasks such as irrigation and drainage which more urgently require mechanization.

Chinese agriculture is intensive and depends on high and rising per-acre yields for increases in productivity. Tractors and other mechanical inputs, if they are to fit in as part of the Chinese agricultural system have to be used in a way which is complementary to other inputs in the system. A typical example of this type of mechanization is a rice transplanter, designed to ease the pressure on labor when rice must be harvested and transplanted on the same field in a matter of days. This allows more multiple cropping over time, and thus raise the productivity of the land without necessarily raising individual crop yields. Machinery can also replace hand labor or draft animals previously used in threshing or transport, and speed the process. Mechanization in China is another way of intensifying agriculture.

Certain jobs in Chinese agriculture will continue to be highly labor intensive for years to come, especially tending the crops. Hand weeding will not soon be replaced by chemical or mechanical means. Weeds are often used as fodder and thus herbicides are not always desirable. Due to the closeness of rows and the intricacies of intercropping, machine weeding is also not possible in many cases. Part of the mechanization program will be provision of more hand-operated fertilizer broadcasters and pesticide sprayers which will make work easier, but will not replace many workers. Gleaning harvested fields will always take relatively heavy labor inputs.

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[38] FBIS, Feb. 10. 1978, p. E11. Number of tractors in standard units. Tractors assumed to be used only for field work and transportation.

[39] FBIS, Nov. 19, 1975, p. E6.

[40] FBIS, Feb. 2, 1978, p. E9.

[41] FBIS, Aug. 16, 1977, p. 12.

Another aspect of mechanization that will extend well past 1980 is the development of new machines to handle particular operations in Chinese agriculture. Wheat, for example, is usually harvested in China before it has dried in the field, in order to allow time for the next crop to grow. At present a mechanical harvester that can harvest wet wheat does not exist. Mechanical rice transplanters, although they are now produced commercially, have much room for improvement.

Mechanization is likely to ease the peasants' labor somewhat overall, and eventually may allow them to work shorter hours. In the medium term, however, planners have other work in mind for those farmworkers released from such operations as plowing, manual irrigation, and pulling handcarts. Mechanization in China will not free labor so that it can be used in another sector of the economy. It will simply free labor to do other agricultural tasks—to plant and harvest more rapidly in multiple-cropping areas, for example. One important task will be to expand farmland capital construction, which has been confined mainly to the wintertime, into a year-round activity. More laborers will be brought into building the whole infrastructure needed to support a mechanized farm system. Sideline activities such as food processing, and the production of some producer and consumer durables will also increase, thus providing even more jobs.

C. Irrigation and Drainage

Nearly one-half of China's cultivated land is irrigated, compared to less than 10 percent in the United States, the Soviet Union, or most European countries.[42] [See appendix for figures on irrigated acreage.] Drainage facilities, which protect flood-prone land, are also extensive. Of the 23.3 million hectares of farmland classified by the Chinese as low-lying, more than two-thirds are now provided with drainage systems.[43]

Water conservancy in China serves, as elsewhere, to raise productivity and yields directly by increasing and regulating the supply of water to growing plants. It also helps protect against drought. Perhaps most important, it facilitates the use of other modern inputs such as fertilizer, increasing their payoff and thus raising yields indirectly as well. The Chinese slogan that "irrigation is the lifeblood of agriculture" is an apt metaphor.

The provision and use of irrigation facilities began in China more than 2,000 years ago. Most irrigation facilities in the past were in the ricegrowing region of the South. According to one estimate, 69 percent of the cultivated land in the rice region was irrigated by 1930, for example, compared to only 15 percent of the wheat region. And most of the wheat region's irrigation depended on unreliable shallow wells.

At the time the People's Republic was founded in 1949, it was in the wheat region, where rain was scarce and unpredictable, and drought and floods were frequent, that additional irrigation and drainage were most needed. Expansion of useful irrigation in the North, however, required heavy investment to control large rivers and to dig deep wells. Until the resources to do this properly began to become available in the 1960's, reliable irrigation in the North remained limited.

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[42] See Nickum, James E., *Hydraulic Engineering and Water Resources in the People's Republic of China.* Standford: United States-China Relations Program. 1977.

[43] FBIS, Nov. 13, 1975, p. E7.

1. THE PATTERN OF EXPANSION

Irrigation facilities were restored and expanded on a wide scale during the 1950's. At their peak in that decade they covered about one-third of China's cultivated acreage. Following the Great Leap, a considerable proportion of China's irrigation facilities were washed out by floods in 1959–61. Irrigated acreage did not recover to its previous peak level until the mid-1960's. Much of the effort of the early 1960's was devoted to repairing flood damage and restoring previously irrigated area.

Since the early 1960's, the focus of much of the expansion of irrigated area has been on North China, and particularly the North China Plain. Of the area affected by floods in the 1950's, most was in the North China Plain. And because rainfall in this area is both sparse and unevenly distributed throughout the year, it is more vulnerable to drought as well. In the most important agricultural areas of the plain, irrigation facilities now cover about one-half the cropland.

The water conservancy construction year begins on October 1 of each year. Most of the work is done during winter and spring, when crop cultivation demands less labor. Progress reports are made at least quarterly, and the figures for each year are generally announced as of September 30. Since the Great Leap, however, press reports have been sporadic.

During the 1970's, the Chinese have continued to expand the acreage under irrigation at an average rate of about 1.6 million hectares per year.[44] The amount of irrigation work which has been undertaken in the north is especially remarkable. In Honan, for example, irrigated acreage has reached nearly 4 million hectares, and high and stable yielding land 2.7 million hectares,[45] out of 7.3 million hectares of farmland. This compares to less than 3 million hectares of irrigated land in the province in 1973 [46] and 1 million hectares in 1965.[47] Comparable progress has been made in the other provinces of the North China Plain.

These irrigation and drainage facilities have improved the productivity of the land considerably. They have helped raise wheat yields directly, and their extension in the north has been coordinated with the development of the small-scale fertilizer industry there, which has also contributed to rising yields. Irrigation has further helped protect crops from drought; the difference between winter wheat stands in irrigated and nonirrigated fields in the North China Plain during the drought in 1977, for example, was quite significant.

One result of this extension of irrigation and drainage, together with other modern inputs and improvements in quality, is that more of China's farmland has been put into the category of high and stable yielding land. As of 1975, this area amounted to 34 million hectares.[48] Assuming that virtually all of this is irrigated, it would amount to more than two-thirds of China's irrigated acreage. Grain output in the northern provinces has increased rapidly as irrigation has raised both the level of productivity and the degree of drought protection in China. However, a number of problems remain, especially since many of the areas remaining to be irrigated are those where water conservancy is more difficult. Extending irrigation is likely to be increasingly costly and complicated. Fifty-five percent of the arable land of north China has yet to be irrigated. In the spring drought of 1977, millions of people had to be mobilized to hand-carry water to affected fields.

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[44] See FBIS, Nov. 17, 1977, p. E12; also FBIS, Oct. 22, 1975, p. 2; and Peking Review, No. 9, Feb. 25, 1977, p. 15.

[45] See FBIS, Dec. 30, 1977, p. E15.

[46] BBC, FE/W722/A/5, May 2, 1973.

[47] BBC, FE/W652/A/3, Dec. 15, 1971.

[48] FBIS, Dec. 4, 1975, p. 11.

2. OTHER ASPECTS OF WATER CONSERVANCY

Irrigation is just one aspect of farmland capital construction in China. In general, the result of a year's work on water conservancy will include some expansion of the irrigated acreage. But this will be only part of the work. A substantial effort goes into leveling and improving land, and into a variety of other tasks. Of the work done on irrigation each year, a large part is devoted to repair, maintenance, and improvement of existing facilities.

In other words, the quality of water control is being improved as the area is extended. Before the sixties, virtually all of China's irrigation was nonmechanized. The water moved only because of the force of gravity or the force of human or draft animal power. The oldest irrigation systems, such as those near Chengtu in Szechwan, continued in use little changed from more than 2,000 years ago. An increasing proportion of facilities are now mechanized and improved over simple gravity-flow types.[49]

More of the water supply in the North China Plain comes from deep wells, rather than the shallow wells and rivers which provided water previously. These deeper wells are a more reliable source of water, and help prevent periodic rising in the water table which deposits undesirable salts in the soil. Conversely, there is now a greater danger of lowering the water table below a usable level. Finally, more inputs from the industrial sector, particularly cement and steel, have been provided for capital construction, so that newer projects can be of higher quality than older earthwork systems.

D. Fertilizer

Chinese agriculture has long depended on enormous supplies of organic fertilizer for the maintenance of yields. Since the founding of the People's Republic, the application of both organic and chemical fertilizer has greatly increased, and fertilizer has been one of the mainstays of the Chinese program to raise yields. While the rapid expansion of production and imports of chemical fertilizer has attracted more attention, the bulk of fertilizer nutrients applied to crops in China continue to come from organic sources.

Organic fertilizer is one of the most important factors in the maintenance of yields in China. Hogs and other animals provide the major source of organic materials for fertilizer, and crops and their byproducts in turn help provide fodder for livestock. When livestock numbers decline, as they did drastically during the 1959–61 period, a vicious cycle begins in which the supply of organic fertilizer is reduced, contributing to a decline in crop yields. Smaller crop output in turn means that less feed is available for livestock, so that their numbers may decline even more, starting the cycle again at a lower level. And since organic fertilizers are relatively slow acting, several years may be required before the fertility of the depleted soil can be restored.

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[49] See appendix for inventory of power equipment.

Because of this interdependence, it is not surprising that the Chinese have stressed livestock production, or that they have coined such slogans as "every pig is a small fertilizer factory" and "the purpose of raising pigs is to accumulate manure." A survey conducted during the thirties indicated that the amount of organic fertilizer available to be applied in China at that time averaged 7.56 tons per hectare. In the rice region it was 8.87 tons per hectare.[50] Recent visitors have found much higher rates of use, averaging more than 200 tons per hectare in some places.[51]

Heavy fertilization, when water supplies are adequate and seed varieties are responsive, is one of the most direct ways of raising yields. Foreign observers and advisers, as well as the Chinese themselves, were long aware that the potential for chemical fertilizer use in China was enormous. Yet while huge amounts of organic fertilizer were used every year in China before 1949, the amounts of chemical fertilizer used were infinitesimal in comparison for a country of China's size. During the first 5-year plan, while a number of fertilizer plants were built, the volume of chemical fertilizer used remained small.

Once the agriculture first policies were instituted in the early sixties, however, the amount of chemical fertilizers applied began to increase very rapidly. The Chinese began to use large amounts of foreign exchange to import both fertilizer and fertilizer plants, and invested more and more heavily in construction of their own plants. In addition to medium- and large-scale plants, the Chinese rapidly expanded production in small-scale plants. The small-scale nitrogen plants produced ammonium bicarbonate, a low-analysis, volatile fertilizer which is little used outside China. While the poor quality of the product was obviously a drawback, these plants took advantage of local resources and reduced the cost of transporting fertilizer to rural areas. They contributed enormously to the growth of fertilizer production after the midsixties.

By the midseventies the rate of growth of production in small plants began to decline. And as imports have become more expensive they have leveled off as well. However, the Chinese in 1972 contracted for the construction of 13 imported large-scale ammonia-urea complexes which have begun to come onstream and which should add approximately 3.5 million tons to China's nitrogen production capacity by 1980. Current plans call for a 58-percent increase in total domestic production of chemical fertilizer by 1980. The Chinese have shown interest in buying and building more fertilizer plants, and the growth of production and use of chemical fertilizer seems almost certain to continue for the foreseeable future.[52]

During the early sixties most of the newly available chemical fertilizer was used in the rice region. Organic fertilizer has traditionally been used most heavily in the south, where the density of population and livestock were greatest. With the decline in the livestock population and the disorganization in economic activity that followed the Great Leap, the amount of organic fertilizer available in the rice region in the early sixties was greatly reduced. To compensate for this decline and to aid in recovery from the disasters of 1959–61, shipments of chemical fertilizer from Chinese plants and from imports were mostly directed to the high-yield grain-producing regions of the south. The rice region also benefited most from the expansion of the supply of chemical fertilizer through the midsixties, since fertilizer was an important complement to the new rice varieties that the Chinese began to plant in the south during the sixties as part of the technical transformation of agriculture.

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[50] This included only animal manure and night soil, not straw, silt, or other materials. See Buck, John Lossing, *Land Utilization in China*, p. 259. Nanking: University of Nanking, 1937.

[51] See, e.g., American Rural Small-Scale Industry Delegation, *Rural Small-Scale Industry in the People's Republic of China*, table VIII-3, pp. 202-203. Berkeley: University of California Press, 1977.

[52] "Peking Review," No. 8, Feb. 24, 1978, p. 10.

Since the late 1960's the wheat region in the north has benefited most from the country's small-scale fertilizer plant program, which has been the largest source of gains in fertilizer production. Steady expansion of the area under irrigation in the north has increased the payoff to fertilizer use, and the northern provinces have achieved greater gains in agricultural output over the last several years.

Within these broad regions, fertilizer has been supplied in the largest quantities to the areas designated as high and stable yielding. This is consistent with overall agricultural policy, and also means that modern inputs tend to be used together so as to best complement each other. While this policy has tended to widen income differentials in the countryside, it has helped to assure that fertilizer has been used most heavily in areas with good irrigation facilities and other appropriate complements. It has also eased the burden on China's agricultural scientific network, which is ill-prepared to do the kind of detailed soil analysis which underlies the distribution of chemical fertilizer in most advanced countries.

Nitrogen fertilizer has received most emphasis in both production and imports. Phosphate fertilizer is next, and potash has only been applied in small amounts. Pre-1949 studies found that soils in most crop areas of China were deficient in nitrogen; that phosphate was the nutrient next most needed, especially in the South; and that potash was not required in most soils.[53] This is probably because chemical fertilizer in China at the present stage is still only supplementary to organics, which tend to supply disporportionately large amounts of potash. As multiple cropping and the use of chemical fertilizer become more intensive, the balance of nutrient requirements may change; for now nitrogen, followed by phosphate, continues to be the element most needed overall.

The growth of chemical fertilizer use, in addition to the already heavy use of organic fertilizer, has been one of the most important components of the technological transformation of agriculture in a large part of China. Fertilizer has also helped in the expansion of multiple cropping, thus increasing the annual yield from each unit of land even more. As part of the package of modern inputs which have been extended by the Chinese on large scale since the institution of the agriculture first policy, chemical fertilizer has made Chinese agriculture more complex and more interdependent with the rest of the economy.

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[53] See, e.g., Shen, T.H., *Agricultural Resources of China*, pp. 32-39. Ithaca: Cornell University Press, 1951. See also Richardson, H.L., and N.F. Chang, "Use of Soil Fertilizers in China," letter to the editor of Nature, in vol. 149, No. 3780, Apr. 11, 1942, p. 410.

E. Pest Control [54]

1. CULTURAL CONTROL

Chinese crop protection from diseases, insects, and weeds is based on cultural practices. The abundant labor supply makes it possible to weed by hand and to cull out diseased plants, retarding the spread of pests. Insects and eggs are removed manually as well as with insect traps.

Rice paddy flooding is very effective in controlling weeds and certain types of insects. Flocks of ducks are also periodically driven through paddy fields to feed upon insects. In a practice known as trapping, a small plot is planted before the rest of the field and attracts insects. A disproportionately large number of insects are then killed with little risk to crops.

Sowing schedules and crop rotations are varied when possible to stay out of synchronization with insect reproduction cycles. In addition, the spread of insects and disease is retarded naturally in China because of the wide variety of strains of rice, wheat, and other crops that farmers in contiguous areas have developed over time.

2. CHEMICAL CONTROL

Since the early 1960's chemical pesticide application rates have grown rapidly. Production of all pesticides in 1963 was 123,000 tons. Production in 1977 was probably more than 500,000 tons,[55] which in gross weight (but not necessarily in weight of active agents) is comparable to the amount produced and consumed in the United States.

Insecticides make up the bulk of China's pesticides. In 1973 China produced 120 kinds of insecticides in 300 factories located throughout the country.[56] Herbicides, which account for most of U.S. consumption of pesticides, are less important in China. Herbicide consumption is increasing, however, even though hand labor remains plentiful.

China still uses large quantities of organochlorines such as DDT which are largely banned in the West. The Chinese are aware of the environmental and pest resistance problems associated with organochlorines and are gradually switching over to organophosphates and carbamates, which avoid most of the problems related to residues. China imports a significant amount of modern pesticides from the West.

3. BIOLOGICAL CONTROL

Biological control methods are taken very seriously in China. Predatory insects such as chalcid wasps and insect pathogens such as *bacillus thuringiensis* are used widely. For example, in 1977 the chalcid wasp was used on 45 percent of the cotton fields in Szechwan to control boll worms.[57] Organized research on new disease resistant seed varieties, however, does not receive enough emphasis. Constraints on the development of biological controls appear to have resulted from the weakness of the agricultural science research system.

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[54] See Committee on Scholarly Communication with the People's Republic of China, report No. 2, "Insect Control in the PRC." National Academy of Sciences, Washington. D.C., 1977.

[55] FBIS, Oct. 5. 1964, p. CCC1; Peking Review, No. 40, Oct. 3, 1973, p. 23.

[56] BBC, FE/W748/A/12, Oct. 31, 1973.

[57] BBC, FE/W963/A/5, Jan. 18, 1978.

4. INTEGRATED CONTROL

China will derive maximum benefit from crop protection in the future from continuation of development of an integrated pest management scheme which includes cultural, chemical, and biological control measures. According to the American Insect Control Delegation, which visited in 1975, integrated control is already used more widely on rice in China than on any major crop anywhere in the world.

Chinese agriculture is part of an ecological system which is more delicately balanced than that of most large developed countries. Pest control must therefore be precisely and strictly controlled. Throughout the countryside fish are raised in every type of water catchment pond, for example, and the use of toxic pesticides which could destroy this source of protein, or have other harmful effects on the health of the Chinese population, needs to be carefully monitored.

As China sows more land to high-yielding varieties of grain, some of the natural protection achieved through seed diversity will be lost. Demand for pesticide therefore will increase, but care will have to be taken to choose suitable methods and products. As pest control problems become more complex, the system of information gathering and dissemination will also need to be improved to make optimum use of the limited number of scientists working in this discipline.

F. Seeds

The development of new seed varieties has been a very important component of the modernization of food production technology in China as it has elsewhere in Asia.[58] Seeds in traditional Chinese agriculture were selected and bred for higher yields and were carefully adapted to local growing conditions. Modern varieties have been developed since the early 1960's mainly to produce extremely high yields with heavy fertilization. Most Chinese work on new varieties has been concerned with rice and wheat, the major crops; corn and other potentially high-yielding coarse grains have also received some attention.

Higher yielding fertilizer-responsive seeds were first used on a wide scale in the rice region. They were planted especially in the Pearl River delta of Kwangtung and in the lower Yangtze valley, where irrigation facilities were extensive and reliable, and fertilizer use was intensive. This was important because the new seed varieties may yield less than traditional varieties without adequate supplies of fertilizer, water, and other complementary inputs.

Extension of new seeds into the wheat region has been coordinated with increases in irrigation and fertilizer supply in the North. The first wave of new seeds, however, came into use on a large scale quite rapidly in the early and middle 1960's. As part of the modernization scheme, they contributed importantly to the increases in output which the Chinese achieved at that time, and the continuing extension of new seeds to areas with the required complementary inputs has helped to maintain increases in food production.

Because of the complexity of the seed program, however, the shortcomings of China's agricultural science program are most evident in the use of modern seeds. New seed varieties are put into use very rapidly on wide areas. In Yulin prefecture—a high-yield rice area in Kwangsi province—for example, where hybrid paddy rice was recently introduced, it was trial cultivated in 1975 on less than 7 hectares; in 1977 it was planted on 133,000 hectares; and this year, according to plan, it will be planted on 267,000 hectares.[59] This in a way shows the strength of the Chinese extension system. But the present rush to put new seeds into use and the fact that uniform varieties are planted over wide areas expose the crops to serious danger from pests. Because of the emphasis on directly productive activity in agricultural science, preservation of indigenous germ plasm has been neglected, and considerable genetic erosion has occurred.[60]

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[58] See American Plant Studies Delegation, "Plant Studies in the People's Republic of China." Washington: National Academy of Sciences, 1975.

Traditionally, crop varieties and cultivation practices in Chinese agriculture had been adapted over centuries to suit local conditions. Thousands of varieties of seeds were in use, for example. The seeds planted in one village, on one slope of a hill, might very well not be quite the same as those planted in the valley on the other side of the hill. The local variety would tend to be resistant to local pests and would generally give maximum yield in the local soil and climate.

The new seed varieties planted in the last 15 years in China, while they are highly responsive to fertilizer and generally produce greater yields, are not nearly so diverse. A pest which affected even just one variety could destroy crops on a huge area, and given the shortcomings of the present Chinese agricultural science system there would be little that could be done about it. The Chinese program for adoption of new seed varieties has been based on a rather high-risk strategy which, so far, has paid off.

G. Agricultural Science: Research and Extension

China's system of agricultural science research and extension is organized so as to focus on getting information from the top down, rather than the other way around.[61] It is geared mainly to the dissemination of modern techniques to be used by agricultural producers. It was not designed to collect detailed micro-information for use in economic planning or to accomplish much serious, advanced work in agricultural science. Thus the Chinese have been able to popularize the use of chemical fertilizer, for example, on a very wide scale, while they have paid little attention to detailed soil analysis at the microeconomic level or to the production of soil maps to aid in the allocation of fertilizer, even though such maps would be useful in planning optimal fertilizer allocation and cropping patterns.

This orientation toward immediately productive results has been both a strength and a weakness of Chinese agricultural science. The Chinese during the last 15 years have been able, over a wide area, to adopt many of the new seeds and the heavy doses of chemical fertilizer that characterize modern agriculture in the rest of the world. But as China's agricultural systems become more and more complex, the existing unsophisticated agricultural science system is increasingly a hindrance to further progress and a potential danger to production.

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[59] FBIS, Feb. 13, 1978, p. H3.

[60] American Plant Studies Delegation, op. cit., pp. 156–160.

[61] See American Plant Studies Delegation, op. cit.

The Chinese at present are reemphasizing science and technology in all aspects of the economy. They explicitly recognize that the current state of their agricultural research efforts is "seriously hindering" the modernization of agriculture.[62] But to build a sound research program capable of independently generating useful results at a suitably advanced level will require more sustained commitment of more resources than the Chinese have been willing to provide in the past. The Chinese have not up to the present developed the facilities, the personnel, or the stock of knowledge required for such efforts.

The Chinese in 1949 inherited a modest program of agriucltural research which had been undertaken by the National Agricultural Research Bureau and others mostly during the 1930's. Some of this work was continued, but it was not until 1957 that the Chinese established their Academy of Agricultural Sciences. The Academy, and the agricultural research program throughout the country, were then immediately disrupted by the Great Leap. Control of some of the research stations was transferred down to the commune level, and agricultural technical work suffered under the strong pressure for production and the disorganization that accompanied the Great Leap.

The Ministry of Agriculture reorganized the system in 1962. Control of agricultural technical stations returned to higher levels, and research efforts on new seeds and other modern inputs were strengthened under the influence of the agriculture first policy. The emphasis on immediately practical applied work remained.

In 1967, during the cultural revolution, the system was altered again. The purpose of this reorganization was to tie agricultural research even more closely to the practical problems of agricultural production in the field. The system was decentralized geographically, and some of the institutes which had been located in Peking were moved elsewhere. Agricultural scientists were required to spend part of their time doing production work with the peasants in rural villages.

This is essentially the form in which the system has existed for the past ten years. The Academy of Agricultural Sciences became the Academy of Agricultural and Forestry Sciences by merger in 1970. It operates a number of research institutes with various functions, such as research on soils and fertilizer.

The research and extension system is organized on several levels, from the national and province-level institutes down to persons working at the production team level. Not all units have research or extensive personnel, but more than one-half the units at county level or below have research units of one kind or another.[63] Some of them are no more than a small village trial or demonstration plot, but they are at least useful in extension of new techniques. More advanced units are more likely to have them, and their number varies from place to place.

The functions of these organizations, where they exist, vary depending in part on their level. According to the plant studies delegation,[64] those at the production brigade and team level are mainly "concerned with testing and demonstrating results" obtained at higher levels; that is, they are more concerned with extension than with research.

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[62] See, e.g., Peking Review, No. 2, Jan. 13, 1978, p. 15.
[63] FBIS, Oct. 11, 1977, p. E28.
[64] American Plant Studies Delegation, op. cit., pp. 5-6.

Those—

> at the county and commune levels normally are concerned more with production and planning than with research. They apparently use research findings in making decisions on production program planning, including seed and chemical needs.[65]

The result of this constant neglect and vacillation in policy has been a system of agricultural science that tends to ignore sustained effort in basic research in favor of intensely practical and production-oriented work. While the system has been successful in introducing new production techniques and in adapting them to local requirements, it apparently has not developed the detailed body of knowledge required to deal with potential second-generation technical problems or to produce independent breakthroughs in agricultural research. Recent visitors have noted these problems, which over the longer term could seriously hamper China's efforts to develop agriculture.

Visiting U.S. agricultural scientists have remarked, among other things, on the lack of communication among provinces and prevailing ignorance of research being done elsewhere in the world that could be of use to China. To quote from the report of one delegation:

> There is evidence of the lack of support for science: poorly equipped laboratories, especially in academies and institutes of agricultural science; little laboratory research activity in all institutions visited (although some institutes of Academia Sinica reported results of recent research); and a noticeable lack of field experiments other than variety tests or plant breeding plots—at most institutes or at brigades being assisted by institutes. Progress achieved so far has been in spite of the lack of facilities and a dynamic, more basic research effort. But progress is not likely to continue over the long term unless this weakness is corrected.[66]

It is still too early to tell what the results of the current emphasis on agricultural science will be, although it may augur a return to a more traditional approach. It is clear that scientific work will need a larger and more consistent long-term commitment of resources if the system is to be able to do even the minimum that a modern agricultural sector requires.

If Chinese crop yields are to be raised to the standard of more advanced countries, agricultural science will have to be greatly strengthened. More advanced countries have achieved high yields not only by simply supplying huge quantities of modern inputs, but also by careful adaptation of those inputs to the precise requirements of local soils and crops. Even if such fine tuning were not necessary in China, continued neglect of basic agricultural research could expose crops to destruction by pests or other causes on an unacceptable scale. Both to increase yields and to assure crop protection, then, in the long run a more adequate capability to do sound basic agricultural research will be necessary for the Chinese.

VI. TRADE

A. Present Situation

In 1977 China imported 6.9 million tons of wheat, and so far 8.0 million tons are scheduled to be delivered in 1978. (See table 2.)

Until late 1976, the PRC had been drawing down grain reserves to avoid spending scarce foreign exchange on new grain purchases.

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[65] Loc. cit.

[66] American plant studies delegation, op. cit., p. 119.

Chinese balance of payments problems were particularly severe during 1975–76. Purchases of wheat subsequently increased as the balance of payments improved, and as Peking began to realize the extent of damage to the 1976 fall harvest from cold and to the spring harvest from drought. Between November 1976 and June 1977, 11.7 million tons of wheat were purchased for delivery through July 1978. [During the spring of 1978, 4.3 million tons of grain were purchased for delivery through August 1979.]

TABLE 2.—CHINA: IMPORTS OF GRAIN, CALENDAR YEARS, 1961–78[1]

[Million metric tons]

Year	Total	Canada	Australia	Argentina	France	United States	Other
1961	5.56	2.26	2.57	0.37	0.26	0	0.10
1962	4.60	2.01	1.23	.53	.28	0	.55
1963	5.45	1.48	3.00	.04	.81	0	.14
1964	6.31	2.07	2.23	1.41	.23	0	.37
1965	5.91	1.60	2.80	1.50	0	0	.01
1966	5.59	2.57	1.31	1.60	.11	0	0
1967	4.94	1.08	2.86	.10	0	0	.90
1968	4.36	2.17	1.59	0	.60	0	0
1969	3.91	1.73	1.85	0	.33	0	0
1970	4.63	1.97	2.22	0	.45	0	0
1971	3.03	3.01	.01	0	0	0	0
1972	4.84	3.09	0	0	0	.94	0
1973	7.63	2.54	.80	.10	0	4.18	0
1974	7.01	1.90	1.39	.73	.21	2.78	0
1975	3.30	1.90	1.20	.20	0	0	0
1976	2.00	1.00	1.00	0	0	0	0
1977	6.90	3.10	3.00	.80	0	0	0
1978[2]	8.0	3.20	2.50	.20	0	2.0	.10

[1] Because of rounding components may not add to the total shown.
[2] Based upon information available through July 1978.

Nongrain agricultural imports also increased in 1977. (See table 3.) China imported an estimated 1.6 million tons of sugar, triple the average for recent years. The low world price was the main motivating factor. Imports of soybeans were also up, making China a net importer of soybeans for the second year since 1949. China has also continued to import soybean oil, a practice started in 1973. Cotton imports have remained fairly steady for the past 4 years, but preliminary data suggest that cotton imports will be near record in 1977–78.

TABLE 3.—CHINA: TRADE IN MAJOR AGRICULTURAL COMMODITIES [1]

[Thousand metric tons]

Year	Exports				Imports			
	Rice	Soybeans	Sugar [2]	Cotton [3]	Rice	Soybeans	Sugar [2]	Cotton [3]
1934–38 average	17	2,036	----------	----------	704	0	352	77
1955–57 average	595	964	3	11	118	0	89	65
1960	1,174	996	16	33	28	0	203	65
1961	444	335	127	11	62	0	1,534	43
1962	577	342	284	0	5	0	938	87
1963	640	332	214	9	97	0	511	174
1964	791	498	527	9	76	0	408	152
1965	552	557	427	4	112	0	419	109
1966	1,264	550	500	2	51	0	620	109
1967	1,197	565	338	9	24	0	556	65
1968	957	571	239	11	----------	0	432	65
1969	801	487	116	11	----------	0	445	87
1970	988	424	88	16	----------	0	530	109
1971	924	460	117	16	----------	0	464	152
1972	899	370	156	16	----------	2	749	435
1973	2,142	310	155	22	----------	255	736	392
1974	1,983	340	51	44	----------	619	411	152
1975	1,440	330	94	66	----------	36	235	183
1976	1,000	200	24	66	----------	25	500	142
1977 [4]	700	125	----------	66	----------	362	1,595	435

[1] Source: Constructed from various FAO and USDA/FAS statistical journals.
[2] Raw sugar.
[3] Crop year beginning Aug. 1.
[4] Preliminary.

Exports of rice and soybeans, traditional foreign exchange earners for China, were down in 1977. The mediocre harvest coupled with relentlessly increasing domestic demand caused a reduction of these exports.

B. Grain Imports and the Stability of Agricultural Growth

Since 1962, when the agriculture first policy was instituted, grain output has only declined in 2 years. As a result, grain imports have not fluctuated widely (refer to table 2). During the seventies, for example, Chinese imports have ranged from 2 million to 7.6 million tons while Soviet grain imports, by comparison, have ranged from 2.9 million to 24.5 million tons.

Perspective on the relative stability of Chinese agricultural growth can be gained from comparison of production trends for China and the U.S.S.R. (see figure 3). Unlike the Soviet Union, where agriculture is dominated by one crop and one weather system, China's crops and climate are diverse. The diversity and intensity of Chinese agriculture have been the major factors in the relative stability of total output. Seldom are both the spring and the autumn harvests poor; seldom is there a poor harvest in the north as well as in the south.

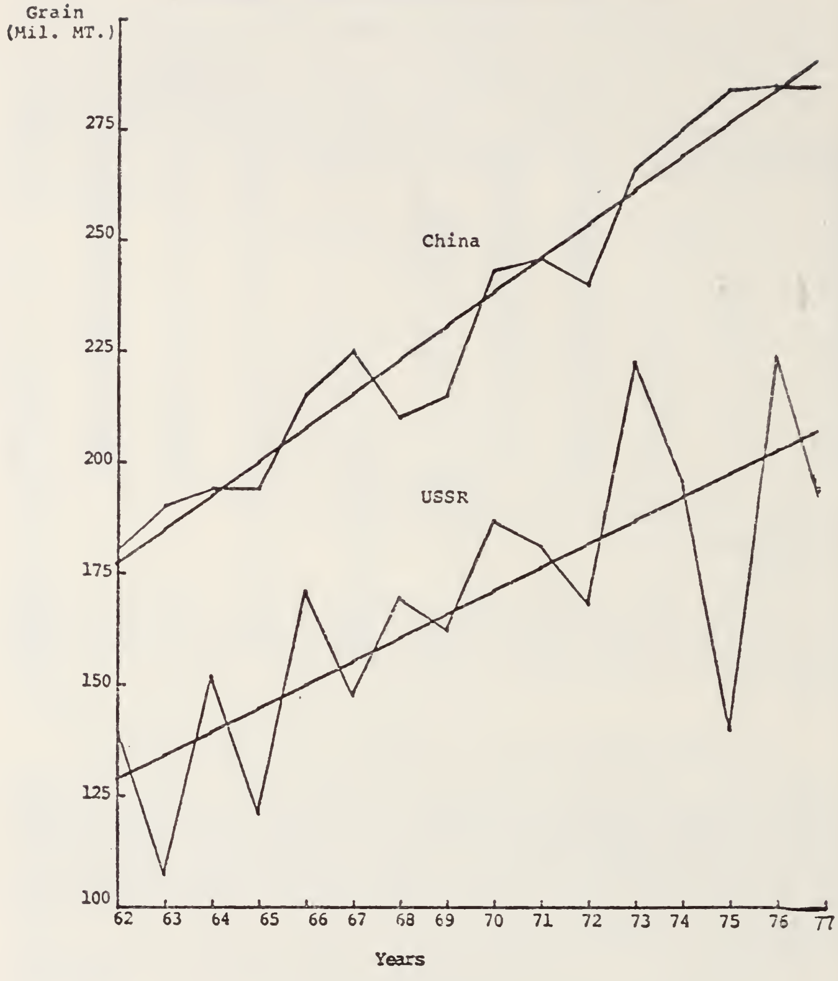

Figure 3.—China-U.S.S.R. grain output time trends.

C. Grain Import Policy

Grain imports since 1962 have been made mostly on a planned rather than an emergency basis. Grain is imported to help fulfill the needs of urban areas in the north. For the past 2 years the Chinese have bought nearly all wheat, which they prefer to corn; in addition they claim that wheat stores better than corn.

Wheat is the main staple grain in northern Chinese diets, and foreign wheat deliveries to the north have eased the burden of taxes and grain procurement on the peasants in this traditionally grain-deficient area. Taxes have been kept relatively low in recent years to help increase the incentives for peasants to produce more grain and to earn more investment funds for agriculture. Importing grain into the major coastal cities also provides some relief to the north's hard-pressed transport system.

D. Prospects for Trade

China cannot rely on grain imports to feed future increases in population—the food requirements of more than 15 million additional people each year are simply too large. However, China will continue to import grain into the north for the foreseeable future, with the amounts imported each year roughly varying with the results of the previous year's harvest.

During the next 5 years the annual requirement for imported wheat will probably be in the range of 5 million to 6 million tons, based on past averages and allowing for some urban growth. The possibility exists that China will temporarily have to increase imports more sharply to buy time for present agricultural development programs to take effect. Nevertheless, we believe these programs are now at least close to schedule, and increases in grain production will stay ahead of population growth except in occasional poor years.

Improvements made in recent years on Shanghai's grain-handling port facilities are evidence confirming the policy of continuation of grain imports. Pneumatic grain loaders/unloaders reported in full operation in 1976 [67] have increased the grain handling capacity of the port of Shanghai by an estimated 4 million tons per year. These improvements should eliminate the type of port congestion that occurred during 1973, when record amounts of grain were imported. Based upon monthly trade statistics for peak import years and the additions at Shanghai, we estimate annual grain handling capacity for the country as a whole to be 14 million to 15 million tons.

Pneumatic grain handling facilities are also scheduled to be built at the port of Huangpu, east of Canton.[68] Plans call for equipment capable of loading or unloading 2 million tons a year. This increase in port capacity is an indication of the potential scope of future plans for Chinese rice exports—possibly a doubling or more of present averages. Development of Huangpu is taking place in three stages, the first of which is nearly complete. The second and third stages, which include the pneumatic equipment, are to begin soon.

Soybean and soybean oil imports will probably increase in the future. Production of soybeans has remained steady for several years, and the prospects for future increases in oilseed production appear limited. Soybean oil at present world prices is a bargain for the Chinese, and as the price of food grains increases relative to that of soybean oil the bargain gets better. It takes approximately 7 hectares of land to produce a ton of soybean oil in China, and the wheat or corn that can be grown on that land is more valuable to the Chinese than the oil and the soy meal. Locally produced chemical fertilizer is fulfilling one of the roles of soy meal, and alternative sources of fodder such as chopped cornstalks can be found for livestock production.

Soybean curd or toufu has become a luxury food, at least in the large cities. According to foreign travelers, when toufu goes on sale there is an almost instant queue of people, all of them holding pots or pans in which the quickly sold-out toufu is carried away. To meet this demand for toufu, at least partially, the Government will probably remain a net importer of soybeans, even though they are not the bargain that soybean oil is.

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[67] "Ta Kung Pao," Aug. 26, 1976, centerfold; "Ta Kung Pao," Jan. 1. 1976, p. 6; FBIS, Feb. 24, 1972, p. C9; FBIS, Jan. 6, 1976, p. G8.

[68] FBIS, Nov. 23, 1976, p. E11.

Sugar is in such short supply that China is likely to buy large quantities any time the price is low. The long-term trend will probably be toward higher average imports as the population increases and as industrial uses such as food processing increase.

Cotton imports have remained fairly steady for the past 3 years at a level below the peak year of 1972–73. Preliminary indications are that imports may be near record in 1977–78. With domestic production of cotton holding approximately level in recent years, the Chinese have held down imports by expanding the domestic production of synthetic fibers.

It is difficult to say what the future of cotton imports will be, because China makes a profit by reexporting cotton in the form of textiles. If foreign demand for Chinese textiles increases fast enough, China could increase cotton imports. The Chinese will be producing more blended textiles in the future, making them less reliant on cotton imports for domestic use.

VII. Food Consumption

Per capita food consumption levels in China appear on the average to have changed little since the 1950's.[69] With the exception of per capita pork output, which has increased, food production has just kept even with population growth. This accomplishment is often praised by foreign observers familiar with the history of famine in densely populated Asian countries including China. Because of the Government's assurance of cheap basic rations, virtually the entire Chinese population is assured of minimum subsistence in even the worst crop years. In this respect consumption can be said to have greatly improved over the past and to be better than in some other developing countries with similar levels of average per capita income. Despite this achievement, China remains very close to the margin of subsistence in providing adequate amounts of food.[70]

Grain and grain products, vegetable oil, and sugar are so strictly rationed in China that it is a criminal offense to sell them outside official chanels. Pork is often rationed as well. The following tabulation shows average monthly adult rations of these foods in kilograms: Grain, 15–20; oil, 0.25; sugar, 0.25; and pork, 0.5–1.0.

Vegetables, on the other hand, have been relatively abundant. They are rarely if ever rationed, and supplies appear adequate year round.

Table 4 shows the overwhelming importance of grain in the Chinese diet. The grain ration may be made up of a combination of several cereals or flour. In the south it is usually rice, and in the North it is mostly wheat and coarse grain. Sweet potatoes are sometimes part of the grain ration, at a weight ratio of five to one. Vegetables also play a very important part in the diet, not only for food value, but also for variety.

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[69] See Smil, Vaclav, "Food Energy in the PRC," in Current Scene, vol. XV, Nos. 6 and 7, June–July 1977, pp. 1–11.

[70] The Food and Agriculture Organization (FAO) of the United Nations' estimates for Asian centrally planned countries show a daily per capita consumption level of 2,170 calories and 60 grams of protein. The FAO claims that this amont meets 92 percent of human food requirements. FAO criteria for need may leave some margin above actual minimum requirements.

TABLE 4.—ESTIMATED CHINESE PER CAPITA FOOD CONSUMPTION, NUTRIENT VALUES

	Kilograms per month	Calories per day	Protein grams per day
Cereals	15.00	1,750	37
Sugar	.25	33	0
Oil	.25	75	0
Vegetables	7.50	56	6
Fruit	1.05	16	(1)
Eggs	.30	15	1
Pork	.80	84	3
Poultry	.25	10	1
Fish	.50	10	1
Other		50	2
Total		2,099	51

[1] Negligible.

VIII. NEAR AND LONGER TERM PROSPECTS FOR FOOD PRODUCTION

In the near future there will probably be a sharp increase in grain production as the imported fertilizer plants come on stream and their output stabilizes at designed levels. In mid-1977 six of the plants were reported operating, but probably only one or two were producing at the designed capacity. Five or six more should be in operation this year. A return to normal or better weather is another factor that is likely to cause production to jump in the next year or two. For the past 2 years, even though poor weather has constrained production, overall improvements to the agricultural system, such as irrigation, drainage, and land leveling, have continued.

The most promising areas for output increases in the near term appear to be the Yangtze Valley and the northeast. Szechwan, a traditionally grain-abundant province along the upper Yangtze, has had sluggish growth in output since the 1950's. It can make a great deal of progress in catching up in the next few years by increasing its multiple cropping index and making use of more fertilizer from new plants. The provinces of the lower Yangtze, such as Hunan and Kiangsu, have continued to make gains in output since the early 1960's. The northeast will be able to make some progress in bringing new land under cultivation and will also benefit from more intensive cultivation of existing cropland.

China's grain production plan for the medium term is extremely ambitious. The Government's output target for 1985 is 400 million tons,[71] compared with 285 million tons in 1977. This goal, which is part of the new 10-year plan, was published during the Fifth National People's Congress.

This goal may conceivably be met, but it is at or near the upper limit of what can be achieved through exploitation of all available means of development. The goal's attainment would imply grain production of more than 350 kilograms per capita—well above the 300-kilogram level achieved in the late 1950's and regained in recent years. To reach this level of output China's planners must obtain substantial and early payoffs from expanded irrigation and seed improvement programs and from the rapidly increasing output of modern chemical fertilizer plants now coming on stream.

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[71] FBIS, March 7, 1978, p. D12.

Realistically, the Chinese are likely to fall somewhat short of the 1985 goal. A great and successful effort to achieve rapid growth in the medium term could nonetheless raise total and per capita output well above past levels. If the population growth rate continues to be kept under control, the Chinese might be willing to accept somewhat slower rates of growth in agriculture. Success in securing higher levels of agricultural production would assure the maintenance of at least subsistence consumption whatever the weather, and would help free the rest of the economy from the vicissitudes of the agricultural sector.

The goal of 4 to 5 percent annual growth in the total value of agricultural production, which is also part of the plan,[72] should not be too difficult to achieve if the grain production target is attained. Other agricultural subsectors, such as livestock and subsidiary production, have consistently grown more rapidly than grain output, and the growth rate of total agricultural output has been higher than that of grain alone.

For the longer term, the results of China's agricultural development programs cannot be predicted with any great accuracy. We do know, however, the probable limits of the range of long-term outcomes. We know, for example, what other densely populated East Asian countries have achieved in terms of crop yields, and how they have done it. We also know approximately how well the Chinese will have to do to maintain subsistence for their population, and we know what they say they have planned and committed themselves to doing.

The use of huge amounts of fertilizer, carefully selected modern seeds, irrigation, effective pest control, and other modern practices and inputs have raised yields in many advanced countries well above those now achieved in China. China has started along the path to agricultural modernization and has achieved initial success in raising yields, but yields in most of the country are well below those of Japan, for example. Grain yields are good by the standards of developing countries, but China has yet to undergo the thorough transformation of traditional agriculture necessary for extremely high average yields.

In the longer term, as yields increase they may well eventually approach the levels that most more advanced countries enjoy today. Rice yields in China now average 3.5 tons per hectare of sown area; if they increased by 50 percent they would slightly surpass the 1975 rice yields of the United States and Greece, for example, although they would fall short of the 1975 yields of Italy, South Korea, and Spain, and well short of recent Japanese yields. In terms of rice yields, China is now in about the same position that South Korea and Taiwan reached in the early and mid-1960's, and that Japan reached earlier in this century (see figure 4). With increasing modernization, Chinese yields are likely to move through the levels that Japan reached in the years following World War II, and that South Korea has achieved since the mid-1960's.

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[72] Ibid.

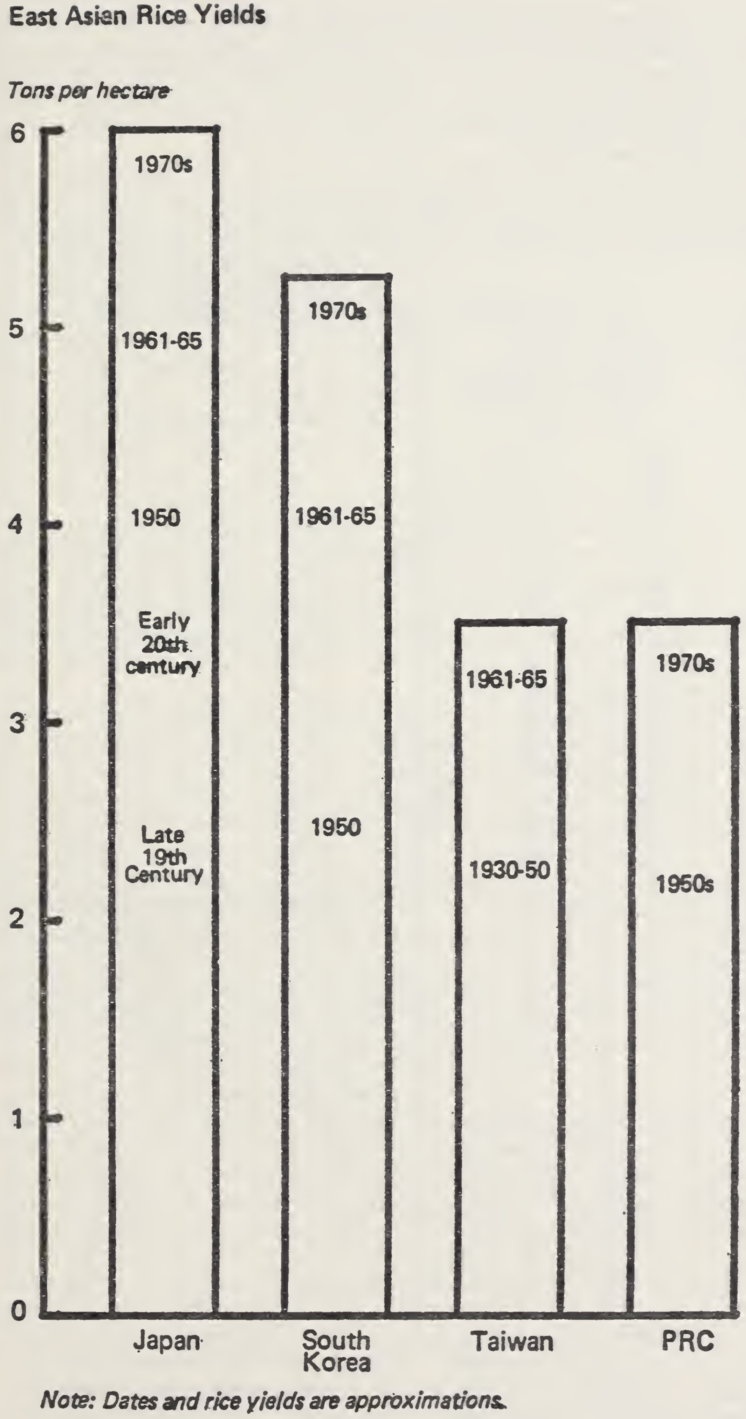
East Asian Rice Yields
Tons per hectare
6
5
4
3
2
1
0
1970s
1961-65
1950
Early 20th century
Late 19th Century
1970s
1961-65
1950
1961-65
1930-50
1970s
1950s
Japan
South Korea
Taiwan
PRC
Note: Dates and rice yields are approximations.

FIGURE 4

Wheat yields average about 1.4 tons per hectare in China. A 50-percent increase would again put yields slightly above those for 1975 in the United States, well above those in the Soviet Union and Canada, but well below most of eastern and western Europe and Japan. A 50-percent increase in grain yields in China, given intensive use even of presently known technology, should therefore be considered to be a reasonable possibility.

A 50-percent increase in grain output by the end of this century would mean an increase of about 10 percent in per capita production. Attainment of this level will plainly require far greater inputs of fertilizer, even more widespread and modern irrigation facilities than now exist, modern seeds and crop protection methods, more serious attention to the development of agricultural science, and better planning and coordination of large quantities of these modern inputs in vastly more complex agricultural systems. These increased supplies of inputs, and their management and coordination, are likely to be increasingly costly. The cost of each incremental unit of grain will increase over time as more and more inputs are concentrated on the limited amount of arable land.

All of this is likely, simply because it will be necessary. The Chinese are almost certain to continue to increase yields and output by more intensive use of modern methods, if only because they have no choice. The only question is whether they have the ability and will to sustain increases in production above the subsistence level. The degree of success they achieve in controlling population growth is crucial, but the Chinese cannot be satisfied to continue to raise output merely at the pace of population growth.

As living standards and the incomes of Chinese consumers rise, demand for agricultural products will increase even more rapidly than population. The demand for food may be inelastic with respect to income in China and other east Asian countries because of the persistence of traditional grain-based diets, but it is unlikely to be perfectly inelastic. Excess demand for some products already appears in the market prices of some foods. Greater variety and higher quality are likely to be the most important demand factors in the foreseeable future, with larger quantities for both humans and livestock also important.

Strong Government emphasis on grain production has already led to a decline in per capita production of cooking oil, soybeans for sauce and beancurd, and some other desirable and necessary components of the Chinese diet. This trend on the supply side is likely to continue in the future, at least until grain production per capita reaches a more secure level. The extension of acreage of corn and other high-yield grain crops at the expense of soybeans and oilseeds has been useful in raising output. The Chinese do not consider coarse grains such as corn to be as desirable as fine grains or soybeans, but they will continue to be necessary. When and if the grain production quantity problem is in hand, the problems of quality and variety will have to be addressed.

An increase of 10 percent in per capita production by the end of the century is in a sense a minimum goal, even though the Chinese may find it difficult and expensive to achieve. Demand for more and better food for consumers, food for livestock, and agricultural inputs in light industry will grow with the rest of the economy. And stable industrial growth depends on minimizing economic disruption from the agricultural sector. The Chinese will have to mount a sustained and well-managed campaign to succeed in breaking out above the subsistence levels of production they have maintained for centuries.

A rapid increase in output during the current 10-year plan, or great early success in controlling the population growth rate, could raise output per capita even sooner and more substantially. Nevertheless, Chinese agriculture is still vulnerable to the weather, and natural disasters of varying degree are inevitable. Occasional serious calamities have to be expected and planned for realistically. Without an increase over present subsistence levels, agriculture will continue to exert a downward pull on the rest of the economy's growth; the agricultural base will not have been made secure.

TABLE 5.—CHINA: GRAIN AND COTTON PRODUCTION ESTIMATES[1]

Year	Grain production (million tons)	Per capita grain production (kilograms)	Per capita grain availabilities[2] (kilograms)	Cotton production[3] (million tons)
1949	111	206	207	0.4
1950	130	237	237	0.7
1951	141	252	250	1.0
1952	161	279	278	1.3
1953	164	278	275	1.2
1954	166	276	271	1.1
1955	180	292	287	1.5
1956	188	298	294	1.5
1957	191	294	293	1.6
1958	206	311	309	1.7
1959	171	253	250	1.2
1960	156	226	223	0.9
1961	168	240	248	0.8
1962	180	252	258	1.0
1963	190	260	266	1.2
1964	194	260	268	1.7
1965	194	254	260	1.9
1966	215	276	282	1.8
1967	225	282	286	1.9
1968	210	257	261	1.8
1969	215	257	261	1.8
1970	243	284	288	2.0
1971	246	281	283	2.2
1972	240	268	272	2.1
1973	266	291	297	2.5
1974	275	295	300	2.5
1975	284	298	300	2.4
1976	285	293	294	2.3
1977	285	287	293	2.0

[1] Field, Robert Michael, and James A. Kilpatrick, "Chinese Grain Production: An Interpretation of the Data." The China Quarterly, No. 74, June 1978, pp. 369–384.

[2] Output and net import or exports.

[3] For years 1949–74 see Alva Lewis Erisman, "China: Agriculture in the 1970's," p. 324 of the 1975 JEC volume, China: A Reassessment of the Economy. 1975: Output was assumed to fall; only a good harvest was claimed. (FBIS, Jan. 5, 1976, p. E2.) 1976: Cotton at best did not decline. No claim was made for 1976. 1977: Cotton output increased but no record was claimed. (FBIS, Dec. 27, 1977, p. E1.) Cotton output stagnant for last 10 years, 1977 production up more than 3 times 1949. (JMJP, Apr. 19, 1978, p. 1.)

TABLE 6.—CHINA: ESTIMATED LIVESTOCK POPULATION

[Million head]

Year	Hogs	Large animals	Sheep and goats
1949	57.752	59.775	42.347
1950	64.006	65.310	46.730
1951	74.401	70.415	52.868
1952	89.765	76.173	61.778
1953	96.131	80.455	72.023
1954	101.718	84.980	81.297
1955	87.920	87.388	84.218
1956	84.0–97.8	87.370	91.654
1957	115.3–127.8	83.457	98.582
1958		85.06	108
1965	160.2		
1967		85	
1970	196.2		
1971	217.8		
1972	248.3	95	147
1973	241.9		
1974	260		
1977	280		160

SOURCES

Hogs:

1949–57—Midyear figures: K. C. Yeh, "Gross Value of Output and Value Added in the Agricultural Sector, 1952–1957," table A.12, p. 34. Mimeograph, 1977.

1956–57—Yearend (higher) figures: Ibid, p. 40. The 1957 yearend figure of 127,800,000 is accepted because of its authoritative sources and the fact that it was published late enough to have been a final estimate. It falls in the middle of the range of 125,000,000 to 130,000,000 head reported earlier in various sources before the Great Leap claim of 145,900,000 head.

1965—The 1972 figure was reportedly 55 percent higher than in 1965 (see FBIS, Sept. 19, 1973, p. B8) and 330 percent higher than in 1949 (see Hung Ch'i, No. 4, 1973, p. 49); the 1965 figure, then, can be calculated to be 2.774 times the 1949 figure of 57,752,000.

1970—11 percent less than in 1971. See FBIS, Mar. 28, 1972, p. B2.

1971—14 percent less than in 1972. See BBC, FE/W654/A/1, Dec. 31, 1972.

1972—Reported to be 4.3 times the 1949 figure (see Hung Ch'i, No. 4, 1973, p. 49).

1973—51 percent greater than in 1965. See Tsen-yang Yang-chu (2d ed.), p. 2. Shanghai: People's Publishing House, 1976.

1974—The number reportedly increased 4.5-fold over 1949 (see FBIS, Nov. 24, 1975, p. E1). We take this to mean that the number in stock was 4.5 times the 1949 figure.

1977—Figure given to Dr. M. E. Ensminger by Prof. Y. Z. Tang of the Peking Agricultural University.

Large animals:

1949, 1951–57—K. C. Yeh, loc. cit. Total of cattle (including water buffalo), horses, donkeys, mules and camels.

1950—Cattle from K. C. Yeh, loc. cit. Others estimated as the mean of 1949 and 1951 figures.

1958—FBIS, Apr. 15, 1959, P. BBB8.

1967—Reported to have equalled or exceeded the previous peak (see "Peking Review," No. 41, Oct. 11, 1968, p. 33).

1972—The number increased by 59 percent, compared to 1949. See FBIS, Sept. 19, 1973, p. B7.

Sheep and goats:

1949–57—K. C. Yeh, loc. cit.

1958—FBIS, Apr. 15, 1959, p. BBB8.

1972—Reportedly increased 3.5-fold over 1949; this is assumed to mean that the number in 1972 was 3.5 times the 1949 number (see FBIS, Sept. 19, 1973, p. B7).

1977—Number given to M. E. Ensminger by Prof. Y. Z. Tang of the Peking Agricultural University.

TABLE 7.—SUPPLY OF CHEMICAL FERTILIZERS

[Thousand metric tons of nutrients]

	Production				
	Total	Nitrogen	Phosphorous	Potassium	Imports
1949	5	5	0	0	0
1950	34	14	0	0	20
1951	67	27	0	0	40
1952	79	39	0	0	40
1953	133	53	0	0	80
1954	205	69	0	0	136
1955	243	84	1	0	158
1956	401	117	14	0	270
1957	429	137	22	0	270
1958	626	202	64	0	360
1959	639	275	94	0	270
1960	710	345	150	0	215
1961	589	280	84	0	225
1962	788	444	104	0	240
1963	1,297	542	215	0	540
1964	1,485	712	416	0	357
1965	2,120	902	578	0	640
1966	2,604	1,046	800	36	722
1967	2,763	883	658	68	1,154
1968	3,128	1,040	761	92	1,235
1969	3,558	1,180	963	100	1,315
1970	4,266	1,562	1,103	116	1,485
1971	4,820	1,900	1,300	140	1,480
1972	5,494	2,345	1,447	152	1,550
1973	6,435	2,930	1,819	168	1,518
1974	6,102	3,162	1,611	180	1,149
1975	6,935	3,661	1,866	207	1,201
1976					1,009
1977	9,088	4,830	2,462	273	1,523

Note: 1949–74—National Foreign Assessment Center, CIA, "China: Economic Indicators," October 1977, p. 12. 1975–77—Unpublished research of Fred Smith.

TABLE 8.—TRACTOR PARK[1]

[Thousand 15-hp units]

	Total	Conventional	Garden
1949	0.4	0.4	(2)
1950	1.3	1.3	(2)
1951	1.4	1.4	(2)
1952	2.0	2.0	(2)
1953	2.7	2.7	(2)
1954	5.1	5.1	(2)
1955	8.1	8.1	(2)
1956	19.4	19.4	(2)
1957	24.6	24.6	(2)
1958	45.3	45.3	(2)
1959	59.0	59.0	(2)
1960	79.0	79.0	(2)
1961	95.0	95.0	(2)
1962	103.0	103.0	(2)
1963	113.0	113.0	(2)
1964	123.0	123.0	(2)
1965	138.4	137.5	0.9
1966	153.6	150.0	3.6
1967			5.6
1968			8.3
1969			11.5
1970	320.1	300.0	30.1
1971			25.0
1972	397.0	351.0	46.0
1973	506.0	432.0	74.0
1974			109.4
1975	784.5	634.5	150.0
1976			216.1

[1] Conventional: Unpublished research of Jim Lewek. Garden: National Foreign Assessment Center, CIA, "China: Economic Indicators," October 1977, p. 13.

[2] Negligible.

	Table 9.—Inventory of powered irrigation equipment (thousand horsepower)	Table 10.—Capacity of rural hydroelectric plants (million kilowatts)	Table 11.—Irrigated area (million hectares
1949	97	(1)	16.0
1950		(1)	16.7
1951	118	(1)	18.7
1952		(1)	21.3
1953		(1)	22.0
1954		(1)	23.3
1955	338	(1)	24.7
1956	508	(1)	32.0
1957	560	(1)	34.7
1958	1,280		
1959	2,535		
1960	4,145	0.5	
1961	4,845		
1962	5,800		
1963	6,440		(30.0–33.0)
1964	7,300		
1965	8,450	.3	
1966	9,980		
1967	10,695		
1968	12,742		
1969	14,790	.5	
1970	16,911	.9	
1971	20,000	1.2	
1972	24,016	1.6	
1973	30,000	2.0	43.3
1974	36,000	2.5	45.3
1975	43,000	3.0	
1976		3.4	
1977	47,000	4.0	(50.0)

[1] Negligible.

SOURCES

Table 9:

1949-75—National Foreign Assessment Center, CIA, "China: Economic Indicators," October 1977, p. 13.

1977—FBIS, Nov. 22, 1977. p. E18.

Table 10:

1949-75—National Foreign Assessment Center, CIA, "China: Economic Indicators," October 1977. p. 13.

1976-77—Unpublished research of Judy Flynn.

Table 11:

1949-57—State Statistical Bureau, "Ten Great Years," Peking, 1960, p. 130.

1963-64—It was reported in 1963 that about ⅓ of China's cultivated land was irrigated, and that some which had been destroyed by floods had yet to be rebuilt. See SCMP No. 3118, Dec. 12, 1963, pp. 8-10. A Hong Kong source gives a 1964 figure of "nearly 500,000,000 mou," implying that irrigated acreage was less than 33,300,000 hectares. See "Ching-chi T'ao-pao" (Economic Reporter) No. 895, Nov. 16, 1964, p. 20.

1973—Figure for 1973 given to the Water Resources Delegation during their visit the following year. See Nickum, James E., "Hydraulic Engineering and Water Resources in the People's Republic of China," p. 51. Stanford, Calif.: United States-China relations program, 1977.

1974—2,000,000 hectares more than in 1973. See FBIS, Dec. 19, 1974, p. E1.

1977—Said to be nearly half the arable land, and 3 times the figure for the early post-liberation stage. See FBIS, Sept. 19, 1977, p. E5.

CHINA'S GRAIN TRADE

By Frederic M. Surls

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I. Summary

The pattern of grain trade of the People's Republic of China (PRC) shifted abruptly in 1961 when China began a large grain import program. Although the PRC has continued to export rice, it has remained a net importer of grains despite slowly rising per capita grain production. During the 1970's, the annual variability of China's grain trade has increased considerably.

Grain imports have become less important in comparison with national grain production, but continue to provide an important part of grain supplies in the urban areas of northern China, as well as adding significantly to the total supply of wheat, a preferred foodgrain. During the 1970's, grain imports have followed fluctuations in per capita production of grains, suggesting that imports have been closely tied to state grain procurements from rural areas in northern China.

China's rice exports have covered a substantial part of the costs of grain imports and the net cost of grain imports has fluctuated far less than the quantity of imports. The level of rice exports appears to be correlated with the cost of the grain import program and to a lesser extent with the level of per capita rice production. But, available information does not provide a full explanation of the determinants of rice exports.

A survey of factors affecting grain import levels suggests that the growth of domestic demand for grains will increase in the future. Increased domestic feedgrain demand for urban livestock raising is also likely. PRC policy appears to favor self-sufficiency in grains, and imports of industrial goods and technology seem to have the highest priority in coming years. Therefore, unless China is successful in increasing the growth rate of grain production and state procurements, pressures will build for higher grain import levels and other economic policy goals will be compromised.

The United States appears at present to be a residual supplier of grain and other agricultural products to the PRC. Until this changes, United States grain exports to China are likely to remain highly variable and substantial on an ongoing basis only if the PRC is unsuccessful in holding down grain import levels.

II. Introduction

The PRC has been an important but increasingly uncertain element in world grain markets. The variability of PRC exports and imports of grain has increased markedly in the 1970's. Additionally, with the resumption of Sino-U.S. trade in the early 1970's, China has become a potentially important buyer of U.S. grains. But actual U.S. sales have been highly variable, ranging from a peak of 4 million tons in 1973 to none in the 1975–77 period. This recent variability of trade and uncertainty about PRC purchasing intentions increases the need to understand what influences China's grain trading patterns.

The objective of this paper is to describe the past pattern of China's grain trade, to examine the probable determinants of both trends and annual fluctuations in grain imports and exports, and to explore the major forces that will be shaping China's trade in grains in years to come. The PRC has provided neither a full explanation nor the data to make a complete analysis possible. Consequently, past trade behavior cannot be fully explained. Nor is it possible to project future trade levels with any certainty. But it is possible to at least sort out the major factors that are potentially important in determining China's grain trading patterns, to identify some of the variables that seem to have been important in influencing grain trade in the past, and to suggest some of the more important forces at work shaping China's future grain trade.

III. Grain Trade Patterns: A Descriptive Overview

The pattern of China's grain trade has varied markedly since 1949. During the 1950's, the PRC was a consistent net exporter of grains. Grain imports during that decade never exceeded 200,000 tons per year, while exports, primarily rice, rose steadily through 1959. Net exports of grain between 1955 and 1960 averaged over 1 million tons per year (table 1).

This pattern of trade shifted abruptly in 1971, when the PRC began a large-scale program of grain imports following a disastrous decline in foodgrain production which began in 1959 and saw 1960 per capita grain production fall to three-fourths of mid-1950's levels. From 1961 to the present, China has remained a substantial net importer of grains despite a return of per capita production to close to pre-Great Leap Forward levels by the mid-1960's. Despite large grain imports since 1961, PRC rice exports have continued to be substantial and an important source of foreign exchange earnings.

Grain Imports

Wheat has consistently been the PRC's major imported grain, although substantial amounts of coarse grains and small quantities of rice have been imported in some years. Wheat flour was imported in 1961 and 1962 but has not been purchased in significant quantities since then. (See app. table 1 for a breakdown of trade by grain.)

TABLE 1.—PRC GRAIN TRADE, CALENDAR YEARS 1952–77

[1,000 tons]

Year	Imports			Exports			Net grain imports[5]
	Wheat[1]	Coarse grains	Total[2]	Rice[3]	Coarse grains	Total[4]	
1952			15	192	122	314	(299)
1953	32		36	268	33	301	(265)
1954	21		21	293	1	294	(273)
1955	1	4	163	624	6	659	(496)
1956		2	89	988	15	1,074	(985)
1957		29	140	485	18	505	(365)
1958	127	31	170	1,265	33	1,299	(1,129)
1959	9		9	1,567	139	1,864	(1,855)
1960			28	1,174	132	1,478	(1,450)
1961	4,093	1,446	5,601	444,	33	598	5,003
1962	3,957	1,160	5,122	578	1	668	4,454
1963	5,455	65	5,617	640	112	862	4,755
1964	5,107	1,110	6,294	784	178	1,073	5,221
1965	5,774	138	6,024	753	264	1,017	5,007
1966	5,743	20	5,814	1,264	239	1,503	4,311
1967	4,133	160	4,354	1,198	91	1,312	3,042
1968	4,340	20	4,393	967	69	1,036	3,357
1969	3,928	6	3,939	811	20	831	3,108
1970	4,950	13	4,963	986	43	1,033	3,930
1971	3,022	107	3,135	924	116	1,043	2,092
1972	4,252	390	4,655	899	142	1,058	3,597
1973	5,982	1,658	7,642	2,142	61	2,210	5,432
1974	5,345	1,428	6,773	1,983	109	2,121	4,652
1975	3,339	95	3,459	1,440	181	1,621	1,813
1976[6]	1,921		2,061	900	168	1,068	993
1977[6]	6,900		6,900	700	100	800	6,100

[1] Includes wheat flour converted to whole grain equivalent.
[2] Includes small amounts of rice imports.
[3] Milled weight.
[4] Includes small amounts of wheat exports.
[5] Total imports minus total exports. ( ) indicates net exports.
[6] Preliminary.

Sources: Riley H. Kirby. "Agricultural Trade of the People's Republic of China, 1935–69." Foreign Agriculture Economic Report 83, U.S. Department of Agriculture, Economic Resource Service, August 1972. Appendix table 1.

Although the Chinese have said little about the end uses of imported grains, most are used for human consumption rather than for feed. Use is largely limited to the major urban areas in coastal northern China where wheat rather than rice is the staple food grain. It, therefore, appears that coarse grains are an inferior substitute for wheat and have thus far been purchased primarily when grain imports are large and foreign exchange pressures severe or wheat unavailable at desired delivery schedules or prices.

During the past, China's grain imports were remarkably stable in comparison with those of other centrally planned economies. Wheat imports during the 1960's averaged 4.7 million tons annually and ranged between 3.9 and 5.7 million tons per year. Combined wheat and coarse grain imports showed a similar stability—an average import level of 5.2 million tons per year and a range of from 3.9 to 6.2 million tons. Between 1971 and 1976, this stability diminished; there is now more uncertainty about the annual level of imports. The average level of wheat imports, for example, was somewhat lower—4 million tons annually—while the range of imports has been considerably greater, varying from a low of 1.9 million tons to a high of nearly 6 million tons. The range of combined wheat and coarse grain imports has been even greater.

Since the average level of Chinese wheat imports has not risen appreciably, the PRC share of world imports has tended downward over time. During the 1960's, for example, PRC wheat imports averaged nearly 10 percent of total world wheat imports and China was the world's largest or second largest importer in all but 2 years. China's average market share has declined somewhat during the 1970's to less than 7 percent, although the PRC was still the leading wheat importer during both the 1973–74 and 1974–75 marketing years.[1]

China's major suppliers of grain have been Canada and Australia and the PRC has been a leading export market for both of these countries. (See app., table 2, for the value of grain imports by country.) In purchases from these countries, China has used long-term agreements to cover a substantial part of import requirements. This is one of the few areas in which the PRC has used such agreements.

TABLE 2.—PRC LONG-TERM GRAIN AGREEMENTS, 1961–77

Country	Date signed	Period	Quantity (million tons)
Canada	May 1961	June 1961 to December 1963	Up to 5.1.
Do	April 1963	August 1963 to July 1966	3 to 5.1.
Do	April 1966	August 1966 to July 1969	4.6 to 7.6.
Do	October 1973	January 1974 to December 1976	4.9 to 6.1.
Australia	do	January 1974 to December 1976	4.7.

The PRC also signed a preliminary agreement in 1973 with Argentina for 3 million tons of wheat and corn to be delivered between 1974 and 1976. The agreement was never ratified, however, and Argentine shipments during the period fell far below this amount. China has apparently found this an expedient means of insuring grain supplies during periods of high import requirements or tight world market supply situations. The agreements have also presumably been useful in bargaining with the grain boards of the two countries.

The PRC was also a major market for U.S. grains during 1973 and 1974. In both years, the PRC was the third largest U.S. wheat export market, accounting for about 7 percent of wheat exports in both calendar years.

Grain Exports

PRC grain exports since 1961 have consistently included both coarse grains and rice and on an irregular basis small amounts of wheat (table 1, app. table 1). Coarse grain exports have been small in quantity, averaging just over 100,000 tons annually during the 1970's, and are shipped primarily to Japan and Hong Kong.

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[1] July–June.

Rice has constituted the bulk of Chinese grain exports since the 1950's. Between 1965 and 1976, known exports averaged 1.2 million tons per year. Additional amounts, substantial in some years, have been shipped to other Communist Asian countries. Lack of information on these shipments seriously obscures the total of PRC rice exports and changes in this total over time.[2] The level of known exports has placed China among the three leading world rice exporters, behind only the United States and Thailand in most years. During the past decade, China's exports have accounted for an average of 16 percent of world rice exports. But, during 1973 and 1974, China was the world's leading rice exporter, accounting for over one-fourth of total world exports in both years.

The majority of Chinese rice is marketed in the Far East, with Hong Kong, Malaysia, Singapore, and Sri Lanka the consistent purchasers. In recent years, Indonesia has been an important but variable market. The Far East and Cuba combined, generally account for at least three-fourths of total PRC exports of rice. The majority of China's rice sales appear to be straight commercial transactions aimed at generating foreign exchange. However, trade with both Sri Lanka and Cuba is conducted on a barter basis, rice for rubber and rice for sugar respectively. These relationships are not strictly commercial; China has frequently met a sizable part of its commitment to Sri Lanka with rice purchased in Southeast Asia.

The Domestic Role of Grain Trade

China's grain import program has provided an important safety valve to the PRC economy since 1961 by supplementing domestic grain production. On the export side, the program has also provided a significant source of foreign exchange earnings.

One measure of the importance of the grain import program to the PRC is the amount of foreign exchange allocated to grain purchases. Between 1961 and 1965, grain purchases accounted for 26 percent of total imports (table 3). By the 1970's, this figure had dropped, but grains still averaged 11 percent of total imports for the 1971–75 period. Since grain imports involve hard currency payments, another measure of the size of imports is its relation to total hard currency exports. Between 1961 and 1964, PRC grain imports amounted to over 50 percent of the value of hard currency exports. Between 1971 and 1975, the average was nearly 15 percent. Thus, the cost of the import program in terms of nongrain imports foregone would appear to be substantial.

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[2] China has only infrequently mentioned the size of its grain trade. One statement referring to 1972 mentioned 5 million tons of cereals imported and 3 million tons of rice exported. This implies exports of 2 million tons in addition to those listed in table 1. If true, most of this would have gone to Communist Asia. It is unlikely that unreported exports have been this high in most years. FBIS I-251, Dec. 29, 1972, p. B5.

TABLE 3.—PRC GRAIN TRADE: VALUE [1]

[Million U.S. dollars]

Year	Total imports	Grain imports [2]	Total exports	Grain exports [2]	Hard currency trade surplus [3]	Balance, grain trade
1961	1,490	330	1,525	50	(215)	(280)
1962	1,150	340	1,520	75	(55)	(265)
1963	1,200	365	1,575	85	(15)	(280)
1964	1,470	420	1,750	100	(40)	(320)
1965	1,845	390	2,035	100	55	(290)
1966	2,035	380	2,210	180	95	(200)
1967	1,955	305	1,960	180	(135)	(125)
1968	1,825	290	1,960	170	(25)	(120)
1969	1,835	245	2,060	125	30	(120)
1970	2,245	280	2,080	135	(265)	(150)
1971	2,310	215	2,455	140	60	(75)
1972	2,850	320	3,150	115	95	(205)
1973	5,225	775	5,075	520	(440)	(250)
1974	7,420	1,070	6,660	815	(1,185)	(260)
1975	7,395	570	7,180	590	(585)	20
1976 [4]	6,005	330	7,250	310	1,115	(20)
1977 [4]	6,800	720	7,800	220	NA	(500)

[1] Imports, c.i.f. China, exports f.o.b. China. All figures are rounded to the nearest $5,000,000.

[2] Value of grain exports and imports have been calculated from partner country trade data where available. When value data was incomplete, unit values were calculated from available data and applied to total quantity. To place value on the proper f.o.b. or c.i.f. basis, 10 percent was added to the value of imports and 7.5 percent subtracted from the value of exports. The lower figure for exports was judgmental, based on the fact that a relatively large share of grain exports go to Asian markets and thus have lower transportation costs. This is a modification of the methodology presented in Editor, "China's Foreign Trade in 1969", Current Scene, vol. VIII, No. 16 (Oct. 7, 1970), p. 3.

[3] Trade with non-Communist countries is used as a proxy for hard currency trade.

[4] Preliminary.

( ) indicates negative number.
NA—Not available.

Source: Total imports, total exports, hard currency trade: Central Intelligence Agency, China: International Trade 1976–77, ER 77–10674 (November 1977), p. 9. Grain Trade: Sources listed in table 1.

This picture in some respects overstates the cost of the import program by neglecting the simultaneous export of grains. The value of exports has also been substantial, accounting for an average of 10 percent of the total value of exports between 1965 and 1975. In net terms, the cost of grain imports has been considerably less, dropping from 40 percent of the value of hard currency export earnings during the early 1960's to only about 6 percent in 1971–74. In both 1975 and 1976, there was a small positive balance on net grain trade for the first time since 1960 although China again reverted to a deficit in 1977. The deficit in 1977 appears to have been the largest ever (table 3). This approach understates the cost of imports, however, since the earnings from grain exports would be available for the purchase of other commodities in the absence of grain imports.

The importance attached to the grain import program at first glance is surprising in view of the relatively small importance of grain imports in per capita grain supplies (table 4). Even during the early 1960's when per capita production was sharply off, net grain imports amounted to no more than 6–7 kg of grain per capita and supplied, at most, 3 percent of per capita grain supplies. This importance in terms of aggregate supplies has tended to decline and by 1975 had fallen to less than 1 percent of domestic supply.

But, these aggregate measures understate the importance of the grain import program. In the first place, grain imports, primarily wheat, provide a substantial addition to domestic wheat production—about 15 percent between 1965 and 1975. Since wheat is a preferred food grain, the import program has had an appreciable effect on the quality of grain supplies.

More importantly, grain imports are more meaningfully viewed in relation to urban rather than aggregate national grain supplies. Although small in relation to total supply, they must constitute a significant part of urban supplies. If a high national population growth rate is assumed, part of the reason for ongoing net imports of grain is the continued low levels of per capita grain production (table 4, alternative I).[3] But, a more important reason is most likely an easing of central government procurement pressures on the rural areas, either because of political decentralization or as an incentive to the rural areas to increase production.[4] In either case, the import program has been essential to reducing requirements for state procurements from the rural areas.

TABLE 4.—PER CAPITA GRAIN IMPORTS AND SUPPLIES

Year	Grain production (Million tons)	Alternative 1				Alternative 2			
		Population (Millions)	Net imports per capita (kilograms)	Grain supply per capita [1] (kilograms)	Ratio [2]	Population (Millions)	Net imports per capita (kilograms)	Grain supply per capita [1] (kilograms)	Ratio [2]
1956–57 average	184	633	(1.1)	289	1.00	627	(1.1)	292	1.00
1960	150	682	(2.1)	218	.75	673	(2.2)	221	.76
1961–65 average	184	721	6.8	261	.90	712	6.9	265	.92
1966–70 average	224	802	4.4	284	.98	780	4.6	292	1.00
1971–75 average	254	898	3.9	287	.99	848	4.2	304	1.04
1971	246	860	2.4	289	1.00	821	2.5	302	1.04
1972	240	880	4.1	277	.96	835	4.3	292	1.00
1973	250	899	6.0	284	.98	848	6.4	301	1.03
1974	265	917	5.1	294	1.02	862	5.4	313	1.07
1975	270	935	2.0	291	1.01	876	2.1	310	1.06
1976	272	951	1.0	287	.99	889	1.1	307	1.05

[1] Grain supply per capita equals per capita grain production (not shown) plus net imports per capita.
[2] Ratio equals supply per capita/1956–57 average supply per capita.
( ) indicates net exports.

Source: Grain production: USDA series (excludes soybeans). This series, which includes a breakdown of grain production into wheat, rice, miscellaneous grains, and tubers is published annually by the Economics, Statistics, and Cooperative Service of USDA in "People's Republic of China Agricultural Situation." Population: Alternative 1—Central Intelligence Agency. "China: Economic Indicators," ER-77-10508, (October 1977), p. 7. These estimates are prepared by the U.S. Department of Commerce, Bureau of Economic Analysis, Foreign Demographic Analysis Division. Alternative 2—Leo A. Orleans. "The Role of Science and Technology in China's Population/Food Balance." Washington: U.S. Government Printing Office, 1977, p. 54. Net imports: Table 1.

IV. DETERMINANTS OF CHINA'S GRAIN TRADE

Several features of the grain trade patterns outlined above require explanation. These include the simultaneous import and export of grain; the major variables determining import and export levels and their relative importance; and the factors accounting for the apparent increase in the annual variability of grain trade in the seventies.

PRC sources are of only limited help in answering these questions. One major reason is the Chinese policy emphasis on self-sufficiency. This was specifically applied to food imports by then Vice Minister of

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[3] A low level of grain production per capita was argued to be the main reason for continuing import, advanced in Mah Feng-hua, "Why China Imports Wheat", China Quarterly No. 41, (January-Marcsh 1971), pp. 116–128.

[4] Political decentralization and lessened central government control over grain surplus is one of the main reasons for ongoing grain imports suggested in Audrey Donnithorne, *China's Grain: Output, Procurement, Transfers, and Trade.* Economic Research Center, the Chinese University of Hong Kong, Hong Kong, 1970. The importance of reduced procurements as an incentive measure is argued in Dwight H. Perkins, "Constraints Influencing China's Agricultural Performance", in Joint Economic Committee, *China: A Reassessment of the Economy.* U.S. Government Printing Office, Washington, 1975, pp. 364–365.

Agriculture Yang Li-kung in a November 1975 speech to the World Food Conference in Rome.

> Feeding the population is a matter of the first importance. A country will be in a passive position if it can't attain self-sufficiency in food and has to rely on food imports for subsistence. It will find itself in an even more critical situation in the event of natural clamities or the outbreak of a war[5] . . .

The absence of a complete Chinese explanation of grain trade patterns is not surprising in light of this policy.

Inadequate domestic production was tacitly acknowledged as the cause of grain imports during the early 1960's, although the significance of these imports was minimized.[6] Since then, however, official statements have not mentioned a production-import link.

Several different official explanations have been offered. These have included importing to meet the needs of friendly countries; importing and exporting grains in order to adjust the mix of different grains in consumption; importing for stocks; and finally exporting grains in order to take advantage of world market grain prices and earn foreign exchange. It is also generally implied that grain exports and imports are in balance.[7]

These explanations do not fully answer the questions raised above. If imports are to adjust the consumption mix or for adding to stocks, then there still remains the question of why this is not accomplished through changes in domestic production rather than imports. With regard to foreign exchange earnings, a Ministry of Agriculture official stated in 1965:

> Thus, if we import wheat, we can export soybeans and rice and other processed food grain—and the price for rice and soybeans is higher than for wheat. This is a good means, in other words, of making money.[8]

Similar statements have asserted that China's grain trade is balanced; that grain trade is simply a means of profiting from world market price differentials.

This latter argument does provide a possible explanation for the simultaneous export of rice and import of wheat. The government has the option of either shipping rice from surplus areas directly to grain deficit areas in northern China or exporting and using the resulting foreign exchange earnings to purchase wheat. Since rice prices are substantially greater than wheat prices on world markets, exporting reduces the foreign exchange cost of supplying a given quantity of grain to deficit areas.[9] Alternatively, as can be seen in table 3, the net cost of the grain import program tends to remain fairly stable for several years at a time. This suggests the possibility of a set foreign exchange budget for grain imports. In this case, exporting rice is a means of increasing grain supplies given this constraint. Transportation bottlenecks and high internal transportation costs may also figure in PRC decisions to simultaneously export and import grain.[10]

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[5] Speech transcript.

[6] Dick Wilson, "Interview with Chen Ming," Far Eastern Economic Review, v. 44, No. 6, May 7, 1964, p. 286.

[7] Representative statements can be found in FBIS I-251, Dec. 29, 1972, p. B5; Peking Review, No. 46, Nov. 15, 1974, p. 15 and Peking Review, No. 41, Oct. 11, 1974, p. 19.

[8] Dick Wilson, "Interview with Chen Ming," Far Eastern Economic Review, v. 44, No. 8, May 21, 1964, p. 367.

[9] Between 1965 and 1975, unit values of PRC rice exports ranged from 2.0 to 3.1 times the unit value of wheat imports.

[10] Donnithorne, *op. cit.*, pp. 2, 4.

Although this can explain the existence of simultaneous exports and imports, it does not explain the reasons for grain imports in the first place and for the shift in the net grain trade position of the PRC beginning in 1961. China would be much further ahead by only exporting grains and not importing at all. Furthermore, it does not explain why the level of rice exports and the net cost of the grain import program varies over time.

A U.N. Food and Agriculture Organization analysis has interpreted the price argument somewhat differently, referring to:

> China's policy of reducing rice exports when, following a decline in the ratio of the price of rice to those of other cereals, it becomes less profitable in terms of balance of payments to export rice and substitute it with imports of cheaper cereals in the domestic market.[11]

Relative rice-wheat prices do offer a possible reason for variations in annual imports and exports—increasing welfare by shifting the mix of domestic consumption in response to changes in world market relative grain prices. But, this explanation also presents problems. Exports and imports involve different parts of the country and hence a very unequal distribution of the gains from this trade. Moreover, grain import decisions frequently appear to precede rice export commitments. When this is the case, the import-export price link is particularly tenuous.

In sum, official explanations offer insights into some facets of China's grain trade and suggest several possible explanatory variables. But, a more complete explanation requires an examination of the supply and distribution system for grains in the PRC.

TABLE 5.—FACTORS AFFECTING GRAIN TRADE LEVELS

Rural sector	Urban sector	Grain import demand/export supply
Grain supply:	Grain supply:	
1. Aggregate production.	1. Procurements from rural sector.	1. Urban shortfall/surplus.
2. Regional production.	2. Urban/suburban production.	2. World market grain prices.
3. Reductions in rural stocks.	3. Reductions in urban stocks.	3. Balance of payments position/ foreign exchange availability.
		4. Trade/debt policy.
		5. Economic priorities.
Grain demand:	Grain demand:	
1. Rural population.	1. Urban population.	
2. Per capita consumption standard.	2. Urban livestock population.	
3. Rural livestock population.	3. Per capita grain consumption standard (ration).	
4. Increases in rural stocks.	4. Industrial uses.	
5. Income.	5. Additions to urban stocks.	
	6. Income.	
Government policy variables:	Government policy variables:	
1. Purchase and tax policy.	1. Rations/consumption policy.	
2. Price policy.	2. Population control (birth rate, transfer to rural areas).	
3. Appeals.		

The Determinants of Grain Trade Levels

The PRC's purchases and sales of grain arise from the interplay of supply and demand forces in China's economy, as well as from foreign trade policy and world market forces. The more important of these are summarized in table 5. As noted above, demand for imported grain arises primarily in the urban sector of northern China. The total amount of grain demanded in this sector is influenced by urban population size, by incomes and purchasing power, and by livestock populations in this sector. State decisions to increase centrally held grain stocks would also increase demand for grain in this sector. Quantity of grain demanded, given these basic demand factors, would vary inversely with the retail price of grain charged by the state, which has handled all grain collection and distribution since the early fifties. But, retail price policies have emphasized price stability; this has precluded the use of prices to clear urban markets. Instead, a comprehensive rationing program has been in effect since 1953. The import demand for grains (or the export supply in surplus areas) depends on the gap between demand and supply available from domestic sources. The domestically generated supply of grain for urban areas consists in small part of grain production in the suburban and near-urban areas and also, on occasion, of net withdrawals from centrally held stocks of grains. But, the major component is the grain procured from the rural areas. Although changes in any of the factors described above can influence grain trade, year-to-year fluctuations in procurements and changes in state stock policies would seem to be the most likely cause of changes in import demand.

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[11] FAO, "The Rice Situation in the People's Republic of China", CCP: RI 77/C.R.S.2 (March 1977), p. 1

State procurements are in turn determined by a complex set of factors in the rural areas. Demand for grain depends on population, incomes, and livestock numbers. Decisions to increase rural stocks—for example the "store grain everywhere" campaign—can be an added important source of demand shifts in the rural sector. Supply of grains is potentially available from rural stocks, but the major source is production. State procurements from rural areas are collected through a combination of agricultural taxes, compulsory delivery quotas, and voluntary sales.[12] Studies of procurements during the fifties, when more data were available, have shown that the state has been unwilling or unable to treat rural consumption as a residual. The level of procurements from the rural areas is, therefore, not fixed but rather appear to be heavily dependent on grain production.[13] The state does, however, have some leeway to alter procurements over time, both voluntarily, through altering purchase prices for grains and other crops, or involuntarily, through changing the share of production extracted as agricultural taxes or compulsory procurement quotas. Given state policies, however, there is most likely a fairly direct relationship between the size of the harvest and procurements for the year.

Regional as well as national production is important in determining the quantity of grain available to the state for urban areas. In 1956 and 1957, for example, the provinces of Szechwan, Heilungkiang, and Kirin accounted for over half of total interprovincial grain transfers.[14] Although this has changed over time, a limited number of provinces account for an inordinate share of total procurements. Flucutation in production in key provinces may have a particularly strong effect on procurements, urban grain supplies and hence on import demand.

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[12] See Audrey Donnithorne, "China's Economic System," London: George Allen and Unwin Ltd., 1967, pp. 337–364, for a discussion of the state procurement system.

[13] See David L. Denny, "Rural Policies and the Distribution of Agricultural Products in China: 1950-1959." Unpublished Ph.D. disertation, University of Michigan, 1971, and Anthony M. Tang, "Policy and Performance in Agriculture" in Alexander Eckstein et al. (ed). "Economic Trends in Communist China," Chicago: Aldine, 1968, pp. 459–507.

[14] Donnithorne, "China's Grain," p. 17. Alva Lewis Erisman has also stressed the importance of regional grain production. For example, see his article "China's Agriculture in the 1970's," in Joint Economic Committee, China: A Reassessment of the Economy. U.S. Government Printing Office, Washington, 1975, p. 344.

Additionally, not all grain procured by the state is available for the urban sector—a sizable part is resold to grain deficit rural areas.[15] Production in deficit provinces can, therefore, have an effect on that part of total procurements available for the urban sector and hence on import demand. Thus, regional production may be as important as national production in influencing imports; moreover, differential rates of growth of production in rural areas—for example, the apparently slow growth of production in Szechwan in recent years and the trend toward self-sufficiency reported in major northern Chinese provinces—may have a strong effect on trends in import demand.[16]

Finally, to further complicate the picture, not all of a gap between urban supply and demand will necessarily be filled by imports. Given the size of the gap, the quantity of foreign grain actually purchased will depend on a number of factors. Most important among these are foreign trade policies, foreign exchange availabilities, the priority given grain as opposed to other potential imports in competition for foreign exchange, and also on the prices of grain in world markets. Given foreign exchange constraints, a rise in world grain prices increases the cost of grain imports in terms of other imports forgone and should result in a reduced level of imports. As described above, relative rice-wheat prices may also play a role in determining both import and export levels. If the entire gap is not filled through trade, then the deficit must be allocated through the urban sector by reducing state allocations for various end uses or by unplanned stock reductions.

This summarizes the potentially important variables influencing grain trade. Total procurements, production in deficit provinces, stock changes, world market grain prices, and foreign exchange availabilities are the most likely important determinants of annual fluctuations in grain imports and exports. Crucial to which of these is most important is the state's willingness to reduce consumption when there is potentially large import demand. The less willing or able the state is to cut consumption and other end uses, the stronger the relationship between production, procurements, and trade. Otherwise, variables in the foreign trade sector rather than the size of the domestic shortfall would play the predominant role in determining imports.

The Major Determinants

Although the potentially important variables can be identified, it is quite another thing to assess their relative importance in influencing past behavior since most of the required data have not been released since the fifties. In particular, regional production data are scarce, and data on rural and urban population and livestock, stock, and procurement data are all unavailable. But, there are estimates of national grain production and population and trade data and world market price data are available.

If the procurement function is stable and stocks of grain are assumed to be relatively small and if other variables do not change rapidly over time, then the demand gap in the urban sector and exportable supplies of rice should vary with per capita grain production. Balance of payments pressures can be approximated in a rough way by the size of the hard currency trade surplus in the preceding year. World market prices or actual unit values of PRC trade can be used to assess world market prices effects.

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[15] During the fifties, on the average of roughly half of gross marketings were resold to rural areas. See Denny, op. cit., table 1, p. 24.

[16] Szchwan has reportedly been a grain importer in some recent years. FBIS I-229, Nov. 29, 1977, p. 53.

On this simplified basis, grain imports should vary inversely with production per capita and world market grain prices and directly with the balance of trade surplus. Rice exports should vary directly with per capita production and world market rice prices. Additionally, the PRC explanations outlined above imply, depending on the interpretation, a direct relationship between export levels and either the rice-wheat price relative or the cost of grain imports.

Ordinary least squares regression techniques were used to test the relationships outlined above for the 1961–75 period and for selected subperiods. As might be expected, the results were not conclusive; there are simply too many important factors omitted. Additionally, there are numerous statistical problems and a very limited number of observations. Nonetheless, the results, if viewed cautiously, are suggestive and of some interest, particularly for grain imports.

Net wheat and coarse grain imports.—For purposes of this analysis, wheat and coarse grain imports were combined since the two are substitutes in human consumption. The relevant production measure was taken as total grain production, excluding rice, since of the available production estimates this most closely approximates wheat and coarse grain production and grain production in northern China.

For the period 1961–75 as a whole and for the subperiod of the 1960's, no significant relationship was found to exist between imports and the variables outlined above. There is no significant correlation between production measures and trade.

Since the Cultural Revolution, however, the preceding year's per capita grain production—excluding rice—and balance of trade surplus appear to explain most of net per capita imports of wheat and coarse grains (table 6, equation 1). The equation fits closely for all years in the 1969–75 period and picks up each turning point in this period. It also predicts the direction of trade movements in 1976 and 1977. However, annual fluctuations in imports for these years are understated (table 7). No relationship was found between imports and absolute or relative prices.

TABLE 6.—REGRESSION RESULTS

	Equation	Corrected R^2	D.W.	Period
Number:				
1	$Y1=68.80-0.34X1-.0736X2+0.0019X3$ (9.44)* (.060)* (.0368) (0.0006)*	0.90	2.35	1969–75
2	$Y2=-2918.6+27.48X4+1.27X5$ (857.9)* (7.30)* (.292)*	.81	2.29	1961–75

Y1=Net per capita wheat and coarse grain imports in kilogram per capita. The population series from table 4, alternative 1 was used in this analysis.

Y2=Net rice exports.

X1=Per capita grain production (excluding rice) lagged 1 year. In kilograms per capita.

X2=Per capita grain production (excluding rice) lagged 2 years. In kilograms per capita.

X3=Hard currency balance of trade surplus in the preceeding year. In million of U.S. dollars.

X4=Average of current and previous year's per capita rice production. In kilograms per capita.

X5=Cost of grain imports. In million U.S. dollars.

Values in parentheses are standard errors of the coefficient. (*) Indicates that the coefficient is statistically significant at the 0.95 level.

D.W.=Durbin-Watson statistics.

TABLE 7.—FITTED, PROJECTED, AND ACTUAL NET WHEAT AND COARSE GRAIN IMPORTS, 1969–78

[In million tons]

Year	Fitted/projected net imports [1]	Actual net imports
1969	3.84	3.91
1970	5.60	4.92
1971	2.83	3.01
1972	4.41	4.88
1973	7.37	7.57
1974	6.25	6.64
1975	3.44	3.25
1976	3.08	1.75
1977	5.80	6.80
1978	7.52	(2)

[1] 1969–75 fitted values, 1976–78 projected. Based on equation 1 of table 6.

[2] Not available.

As noted above, this should be viewed cautiously. But, the apparent increase in the responsiveness of imports to production fluctuations since the late sixties is striking, suggesting less willingness or ability in recent years to hold down consumption during years of production shortfalls. This would account for the increased variability of PRC grain imports during the seventies.

Several qualifications are in order, however. Stock changes may have had some effect on import demand during this period. No meaningful responsiveness to world market grain prices was observed. But, Chinese grain purchases must respond somewhat to changes in market prices. For example, it seems likely that low world wheat prices will tend to raise imports by reducing the foreign exchange costs of a given level of imports. The low world wheat prices during spring and early summer of 1977, for example, likely influenced both the timing of wheat purchases—the PRC filled import requirements through mid-1978 at that time with two large contracts with Canada and Australia—and also most likely the total quantity slated for import as well.

Moreover, the focus on national production may overlook important but temporarily offsetting trends, including declining or slowly growing marketable surplus in major grain surplus areas and faster-than-average growth of production in traditionally deficit areas of the North China Plain. Future changes in regional production trends could play a role in trade that does not show up with national production data.

Net rice exports.—Attempts to explain rice exports were less satisfactory. A major problem is lack of information on rice exports to Communist Asian countries. For the period 1961–75 as a whole, there appears to be a rough relationship between net rice exports, per capita rice production, and the costs of the grain import program (table 6, equation 2). Balance-of-payments pressures as measured by the lagged hard currency trade deficit and the relative price of rice and wheat were not found to be significant.

In addition, the statistical importance of these variables changes over time. Costs of grain imports were not significant during much of the sixties, while production and rice prices seem to be important. During the seventies, however, costs seem to best explain the level of exports, and production drops out as a significant variable. High correlation between rice prices and the cost of grain imports makes it difficult to choose between these.

Finally, these relationships do not do a very effective job of tracking year-to-year fluctuations in export levels. Although production, prices, and the cost of grain imports appear important, their relative importance and precise roles cannot be sorted out.

Tentative conclusions suggested by this analysis include the following:

(1) The determinants of grain imports presented by equation (1) seem reasonable as a first approximation although there are clearly other factors at work as well. Production in the previous year determines procurements and hence urban grain supplies for the current year.

(2) Links between rice production and trade are weak, in part because full trade data are not available. Also, rice production per capita has risen substantially since the sixties; this has likely resulted in an increase in State rice stocks sufficient to weaken direct production-procurement-export links. But, declining or stagnant production over a period of time can result in stock drawdowns and restore a production-export linkage. This was probably an important factor in the low export levels during 1976 and 1977 as rice production stagnated in the 1974–77 period.

(3) Either or both rice prices or the cost of grain imports have an effect on rice exports, but their separate effects are difficult to disentangle. The net cost of grain imports has tended to remain stable for several years at a time (table 2). This suggests a foreign exchange budget for grain imports with rice exports adjusted as far as possible to meet grain import costs. Relative rice-wheat prices do not seem to be important to either grain imports or rice exports.

(4) Wheat import decisions seem to be largely independent of rice export decisions, at least during the 1970's. However, the reverse may not be true. Part of the reason for this lies in timing. Wheat import decisions have typically been made in advance as production and procurements from the preceding year's crop becomes apparent. Rice export decisions, on the other hand, appear to be made with a shorter lag. Stocks, anticipated current-year rice production, costs of grain imports, and world market rice prices all enter into the export decision.

V. The Future of China's Grain Trade

With only limited understanding of the determinants of past trade behavior and of the forces shaping future demand and production, projection of future PRC grain trade is highly speculative. However, it is possible to identify probable directions of change in many of the variables discussed earlier. Such an analysis suggests accelerated growth of demand for grains in the future and pressure for higher grain imports unless the growth rate of grain production is raised.

In the urban sector, the growth rate of demand for grains is likely to rise in years to come. The recent wage increases and rising incomes in the future will generate rising demand for grains as well as other agricultural products. To some extent, this will take the form of increased direct demand for high quality food grains—wheat and rice—but more importantly it will generate rising demand for meat and livestock products. Much of this increase in demand is to be met by increased livestock production in the urban sector. This is indicated by recent statements calling for self-sufficiency in production of livestock production in major urban areas and for mechanization and semimechanization of livestock raising in these areas.[17] This should accelerate the growth of demand for feed-grains in urban areas, a potentially important shift in the nature of urban grain demand.

Adding to these demand pressures is renewed emphasis on increasing grain stocks. This has long been a PRC policy goal, but it is unlikely that much progress has been made on this in recent years.[18]

The net effect of these factors will be an increase in the rate of growth of demand for grain procurements. Recent emphasis on material incentives and raising living standards also seems to indicate that the new leadership may be less willing to restrict consumption in periods of supply shortfall. This would tend to further increase the annual variability of grain imports, at least until the level of state stocks is increased.

Given these demand developments, the growth of state procurements in years to come will be crucial. But, there are similar demand pressures building in rural areas which have implications for procurements. Particularly important in this respect is the goal of increasing incomes of 90 percent of the rural population in years of normal harvests.[19] Other things remaining equal, this will tend to hold down the level of compulsory state grain procurements and increase their year-to-year variability. Although this could be offset by a reduction in population growth rates, there are real questions as to how rapidly this can in fact be done.

Given these pressures, PRC import demand for grains seems likely to rise in years to come unless there is an acceleration in the growth of grain production. In light of China's conservative international financial policies and the high priority given imports of technology and industrial goods in the new 10-year plan, such a rise in import levels would be highly disruptive to achieving the ambitious plan targets for modernization and economic growth. Higher grain import levels, plus increased variablility of imports, also create problems for foreign trade planning by generating uncertainty and increasing the risk of long-term foreign exchange commitments, for example, for complete plant purchases. Moreover, a substantial rise in imports would be at variance with the importance placed on self-sufficiency in grain production.

It is, therefore, likely that one reason for the increased emphasis on agriculture in the new plans is to offset the buildup of demand pressures and rising grain imports. There are two aspects of these plans. The first is the approximate doubling of the annual rate of growth of grain production implied in the 1985 grain production target of 400 million tons. Perhaps equally important is the strong emphasis in both provincial and national reports of the need to increase grain marketings. Most notable in this respect are plans to develop marketable grain bases, apparently with the help of increased state investments, and to increase the purchase prices of agricultural products.[20] These latter plans appear to aim at increasing the share of grain production entering state distribution channels. The success of these plans will be crucial to holding down grain import levels while achieving the income and stocking objectives of the new leadership. The future pattern of China's grain trade hinges on the success or failure of these efforts.

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[17] FBIS I-202, Oct. 19, 1977, p. E1 and FBIS I-236, Dec. 8, 1977, p. E12.

[18] FBIS I-217, Nov. 10, 1977, pp. E3-E5.

[19] Hua Kuo-feng, "Unite and Strive to Build a Modern, Powerful, Socialist Country" (Report to the First Session of the Fifth National People's Congress), FBIS I-52, Supplement 1, Mar. 16, 1978, p. 23.

[20] Ibid, pp. 16, 22.

VI. China and United States Grains

A final question is the PRC as a market for U.S. grains. Following the resumption of Sino-American trade in the early seventies, PRC purchases of U.S. wheat and corn began in late 1972 and climbed sharply in 1973 and 1974 (appendix table 2). By 1974, however, the atmosphere was changing. The PRC canceled several contracts for U.S. grain as the year progressed, and the last shipments of U.S. grain moved in December of 1974. No further purchases were made until April 1978, even during 1977 when China was buying record amounts of wheat.

The initial surge in purchases of U.S. grains appears to have resulted primarily from China's high import requirements in 1973 and 1974. The reasons for the subsequent cancellations of orders in 1974 are less clear. The PRC may have overpurchased and used cancellations to cut back on deliveries. This seems possible in light of China's large and growing trade deficit and other disruptions to trade plans encountered during the year. Additionally, the PRC began registering complaints about the quality of U.S. grains and soybeans. The presence of TCK wheat smut was grounds given for rejection of several shipments and delays in accepting others.

Although PRC inspection standards have remained a potential problem imposing high risks of rejection on exporters of U.S. wheat, it is not clear how serious a problem this is. As the most recent purchases indicate, if the PRC is interested in U.S. grain, ways can be found to meet their quality requirements.

The major problem with U.S. sales appears to be the treatment of the United States as a residual supplier of agricultural products. This reflects both the PRC's longstanding trading relationship with Canada and Australia and also Chinese policy growing out of the unresolved state of Sino-American relations. This policy seems to apply to purchases of most U.S. agricultural products. Under these conditions, U.S. sales of agricultural goods are unlikely during years such as 1975 and 1976 when PRC import levels are low and supplies ample in other countries. PRC purchases of U.S. grains and other agricultural products are most likely in years when total PRC imports of these commodities are high and there are low stocks and production problems in other supplying countries. In the specific case of grains, supplies from non-U.S. sources were ample during 1977. Consequently, despite orders for nearly 12 million tons of wheat placed in an 8-month period, no purchases were made from the United States. In 1978, however, additional supplies were unavailable from Canada and Australia for the desired delivery periods. Hence, purchases of U.S. grain resumed.

As long as this policy continues, U.S. agricultural trade with the PRC will tend to be irregular and more variable than total PRC agricultural imports. Substantial sales can be expected in some years and relatively little in others. However, should the growth of grain production and procurements in China fail to keep pace with demand increases and average import levels rise, the PRC could become a steady purchaser of U.S. grains in the future.

Appendix Tables

TABLE 1.—PRC GRAIN TRADE, BY GRAIN, 1961–77

[In thousands of tons]

Year	Imports								Exports				
	Wheat	Wheat flour [1] [2]	Corn	Barley	Oats	Rice	Other	Total	Rice	Wheat	Corn	Other	Total
1961	3, 599	494	44	1, 237	65	62	100	5, 601	444	121	30	3	598
1962	3, 650	307	492	350	47	5	271	5, 122	578	89	1		668
1963	5, 454	1	13	25	27	97		5, 617	640	110	110	2	862
1964	5, 032	75	377	570	134	77	29	6, 293	784	111	170	8	1, 073
1965	5, 751	23	72	24	42	112		6, 024	753		254	10	1, 017
1966	5, 743		20			51		5, 815	1, 264		227	12	1, 503
1967	4, 133		160			61		4, 354	1, 198	23	75	16	1, 312
1968	4, 340		20			33		4, 393	967		51	18	1, 036
1969	3, 928		5	1		5		3, 939	811			20	831
1970	4, 950		13					4, 963	986	4	1	42	1, 033
1971	3, 022		107			6		3, 135	924	3	93	23	1, 043
1972	4, 252		390			13		4, 655	899	17	99	43	1, 058
1973	5, 982		1, 626			2	32	7, 642	2, 142	7	26	35	2, 210
1974	5, 345		1, 428					6, 773	1, 983	29	77	32	2, 121
1975	3, 339		95			25		3, 459	1, 440		115	66	1, 621
1976 [2]	1, 921					140		2, 061	900		126	42	1, 068
1977 [2]	6, 900							6, 900	700		58	42	800

[1] Converted to whole grain equivalent.
[2] Preliminary.

Sources: Riley H. Kirby, "Agricultural Trade of the People's Republic of China," 1935–69. Foreign Agricultural Economic Report 83, U.S. Department of Agriculture, Economic Research Service, August 1972. Partner country trade statistics. United Nations series D trade extract tapes. FAO, "The Rice Situation in the People's Republic of China," CCP: RI/C.R.5.2, March 1977. USDA estimates.

TABLE 2.—PRC GRAIN IMPORTS BY COUNTRY OF ORIGIN, 1961-76[1]

[In millions of U.S. dollars]

Year	Argentina	Australia	Canada	France	United States[2]	Others	Total
1961	2	132	119	11	------	35	299
1962	26	70	138	32	------	43	309
1963	3	177	97	41	------	12	330
1964	91	125	126	30	------	11	383
1965	83	157	97	1	------	16	354
1966	84	78	169	6	------	9	346
1967	6	177	83	------	------	12	278
1968	1	85	146	27	------	6	265
1969	------	106	111	13	------	8	222
1970	1	123	116	17	------	1	256
1971	6	2	189	------	------	1	198
1972	1	------	229	------	59	2	291
1973	14	53	187	------	447	2	703
1974	84	190	341	29	330	1	975
1975	20	199	302	------	------	1	520
1976	------	124	145	------	------	35	304

[1] Based on values as reported by country of origin. Therefore, excludes transportation and insurance costs, which have been added in table 2.

[2] Includes value of grain transhipped through Canada.

Sources: For the countries listed, data is from official country trade statistics. Values for countries listed under "other" includes both official trade statistics and estimates based on known quantities and unit values calculated from countries reporting both quantity and value of exports to the PRC.

THE EVOLUTION OF POLICY AND CAPABILITIES IN CHINA'S AGRICULTURAL TECHNOLOGY

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Introduction

The most important and often asked question about Chinese agriculture is whether it can generate a sufficiently rapid increase in total product to sustain at constant or improving consumption levels a population which will continue to increase for many years to come. At present it is only possible to answer with expressions of optimism or pessimism founded largely on faith or on the assumption that past trends will continue. A more convincing answer would relate past trends and future potential increases in "inputs"—land, labor, various forms of capital, and weather conditions—to realized or expected changes in "outputs"—production of agricultural products. But to begin to define the relationship between inputs and outputs, whether in qualitative or quantitative terms, one must have a prior understanding of the "technology" which defines the structure of the relationship, of the process generating changes in this technology, and of the effects these changes have had and will have on the stability of the input-output relationship.

Economists, including those studying China, have tended to confine their conception of technology to a "residual effect"—the "source" of changes in output which cannot be accounted for by changes in inputs within a static input-output relationship (or "production function").[1] This approach is of no value in predicting the future, when *ceteris paribus* is rarely an appropriate assumption, and can be terribly misleading in "explaining" the past. Econometric studies of production functions are unreliable unless technological change is explicitly accounted for, because changes in conventional input use are so highly correlated with changes in technology that omission of the latter leads to biased estimates of the effects of inputs. For example, growing fertilizer use appears to have been closely correlated with historical increases in rice yields in Japan, until the rate of diffusion of improved seeds is introduced into the equation. Then, as Hayami and Yamada have shown, the estimated marginal effect of increased fertilizer use (*ceteris paribus*) becomes very small.[2]

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[1] For an example of this approach, see Anthony M. Tang, "Policy and Performance in Agriculture,' in A. Eckstein et al., eds, *Economic Trends in Communist China* (Chicago: Aldine, 1968).

The spread of improved seeds, however, is only one of the more quantifiable aspects of a complex process. This paper will avoid quantification, but will build a base on which quantification can proceed: To begin to predict future rates of technological advance and lag times before full diffusion, we need to know how technological change is generated and implemented in China; to begin to predict changes in the structural relationships among inputs and outputs, we need to understand the underlying strategy and objectives of Chinese agrotechnical policy and the extent of their harmony with the perceived self-interest of peasants; to begin to predict the quantitative importance of technological change to production levels, we need to assess the forces determining probabilities of success or failure and potential and realized economic impact of individual innovations. These topics are explored in this paper through a set of illustrative case studies of interrelated aspects of technology as they have developed over the past two decades and can be expected to unfold in the next few years. The aspects are loosely classed as improved seeds, fertilizer use, irrigation and water control, mechanization, and improved techniques. The case studies are not intended to cover all important developments over the period.

We begin with some working hypotheses, which may be appraised in the light of the case studies. First, to provide a crude paradigm of the process of technological change in China: it involves an interaction among scientists and technicians, politicians (i.e., higher level cadres), and peasants (including lower level cadres). Scientists and technicians are under pressure to make breakthroughs on problems deemed significant to economic production but a research achievement is in the first instance measured on scientific or technical, rather than economic, criteria. It undergoes peer review, which may pit younger researchers, untainted by preliberation or Western training, against an older (and sometimes wiser) group of colleagues, but this screening process is not as rigorous in China as elsewhere since the originator(s) may counterattack with the accusation that their disparagers have an insufficiently Marxist or Maoist spirit (i.e., are negativist), against which accusation there is no effective defense.

When a breakthrough is documented by evidence, albeit on narrow criteria of measurement, it may attract the attention of local politicians, in whose interest it is to obtain recognition by translating the breakthrough into increases in key production measures. This may be a low-risk proposition for the politician, who can blame misleading technical data if failure results. With political support, the innovation is subjected to large-scale experimental testing, but the tests may be hasty, unscientific, carelessly monitored, or again evaluated on excessively narrow criteria. If it passes these tests, the politicians are in a position to apply pressure for rapid and large-scale implementation in production, where for the first time any economic drawbacks may become fully apparent.

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[2] Y. Hayami and S. Yamada, "Agricultural Productivity at the Beginning of Industrialization," in K. Ohkawa et al., eds., *Agriculture and Economic Growth: Japan's Experience* (Princeton: Princeton University Press, 1970).

It is the peasants and grassroots cadres who are likely to notice and articulate any major economic weaknesses; if they are severe, and depending on the degree of voluntarism currently acceptable, they may abandon the innovation or resist its implementation. A high volume of promotional propaganda is frequently an indicator of such resistance. Peasants may not immediately perceive a net loss of social product, however, if the adoption process is subsidized in some way by the state, as must often be the case. Nor, for that matter, do the promoters ever publicly net out the cost of such subsidies in their published assessments of economic impact.

Failure eventually results in a period of reassessment, in which professionals who were previously reluctant to speak emerge to criticize the innovation, although less openly if the prestige of the political promoter(s) has been laid on the line. Rarely does such a discussion end in total discrediting of the innovation—usually the critique focuses on the limits or preconditions for its applicability, in part as a face saving device, and attention turns to means of removing these limits or fulfilling the preconditions. After a period of retrenchment, a modified or qualified version of the same innovation may be promoted once again with greater caution.

This paradigm suggests that the process of technological change in China, in contrast to other countries, embodies a less conservative or skeptical view of innovational potential, a higher risk of economic failure of implemented innovations, but also a very short lag between technical or scientific breakthroughs and large-scale diffusion. Elsewhere the process is slowed and made less risky by the need to demonstrate overwhelming economic superiority before a conservative peasantry can be persuaded to adopt.

Secondly, the underlying strategy and objectives of Chinese agrotechnical policy have been well-summarized by Ishikawa as:[3]

> (1) The utilization, as much as possible, of the local resources for agricultural inputs (designated as "traditional" inputs in contrast to "modern inputs");
> (2) Economizing, as much as possible, of modern input (here defined as the inputs produced with the use of nonfarm resources); and
> (3) Research and development of scientific methods for productivity increase on the basis of traditional inputs or the combination of traditional and modern inputs.

Another way of putting it is that the state has behaved as if it sought to maximize annual output (not output of each crop), subject to a virtually fixed constraint on cultivated acreage, tight constraints on the availability of liquid capital within the rural sector for purchase of outside inputs, but with no constraint on the supply of labor except perhaps in busy seasons. The obvious prescription for new technologies which increase the intensity of labor use (over the year as a whole) has been followed since the 1956 formulation and 1960 ratification of the national agricultural development program, the annual grain-yield targets of which are still the major measures of local achievement.[4] As the state has come to recognize the importance of seasonal labor bottlenecks, however, there has been greater emphasis on selected laborsaving innovations.

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[3] Shigeru Ishikawa, "Agrarian Reform and Its Productivity Effect—Implication of the Chinese Patterns," in *The Structure and Development in Asian Economies* (Hitotsubashi University Institute of Economic Research, Paper No. 10, September 1968).

While at first glance the above objectives seem appropriate for a labor-surplus economy, Chinese agrotechnological policy has at times seemed to ignore (or actively preclude) the existence of off-farm or subsidiary earning opportunities and the desire of the peasant for some leisure. That is, the peasant, unlike the state, has never regarded additional time spent in labor as having zero opportunity-cost,[5] and a times has preferred leisure or lucrative side occupations to the less productive agricultural or capital construction tasks. This conflict of interest on occasion has threatened the principle of voluntarism as applied to the diffusion of state-promoted technologies.

While groping for forms of technological change compatible with the above objectives, the "package" promoted has gone through recognizable stages. In the first stage, which ended with the failure of the great leap in agriculture and the open breach with the Soviet Union, some characteristics of the Soviet technological model were adopted; that is, an emphasis on large-scale, multipurpose water control projects, heavy tractors and European-type plows, a Lysenkian faith in deep plowing and dense planting and a relatively unproductive research program. More recently, features of the Japanese or Taiwanese technological models have been ascendant, including an emphasis on hybrid-seed development, intensive fertilizer use, power tillers, pumps, and other small machines, and a well-organized research and extension network. But these "stages" more largely reflect changes in capabilities, emphases, and regional focae than any deliberate emulation of foreign example.

IMPROVED SEEDS

Because of the complex interrelationships among all factors contributing to the improvement of productivity in agriculture, it is difficult to isolate one factor as more important than others. Nevertheless, it is today common to treat the development and diffusion of improved seeds as the sine qua non of a sustained increase in land productivity, especially in view of the importance of this factor in successful cases of long-term productivity growth such as Japan and the United States.

The rate of growth and timing of the contribution of seed improvement to agricultural development is constrained in three ways:

> (1) If the process depends on the traditional method of seed selection, it is limited by the natural rate of genetic mutation and by the thoroughness of the attention devoted to selection by farmers and researchers. Scientific hybridization and other artificial methods can direct and greatly speed up the process of achieving a desirable genetic combination, although selection continues to be important in determining appropriate biological parents and refining and maintaining the characteristics of subsequent generations.

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[4] Released by NCNA, Apr. 11, 1960, and reproduced in *CB* 616.

[5] Strictly speaking, the state has recognized competing uses of labor, but often seems to ignore their economic value relative to the practices being promoted at the moment.

(2) Hybridization requires decisions about breeding objectives, since there may be many characteristics which need improvement and only one or two may be served by a given crossing. Nor will vague objectives, such as "yield improvement," suffice as guidelines, since yields depend on a variety of plant and environmental characteristics. The appropriate objectives are not necessarily the most obvious, and much time may be wasted in pursuing ill-chosen ones.

(3) From initial crossing, through stabilization of characteristics, local trials, multiplication, and distribution, a number of years are required—historically, 12 or 13 in Japanese rice breeding, for example, including 3 years for distribution.[6] While there are ways of reducing this timelag, a too hasty program courts disaster.

The Chinese seed breeding program initially suffered under each of these limitations. From the start breeders were under party pressure to achieve rapid high-yield breakthroughs.[7] Thus they inevitably relied first on a combination of farmer selection, Republican-period experiment station products, and imported varieties. For example, of 95 improved rice varieties distributed in South China before 1959, only 20 percent were products of post-1949 breeding by professional agronomists; and 40 percent of the improved varieties distributed in North China were Korean or Japanese imports.[8]

The diffusion of improved varieties required the development of an extensive network of experimental stations, which occurred in parallel with the cooperative movement and reached the level of about one station per 8,000 households in 1956.[9] Centralized direction and organization of these institutions apparently were not formalized until 1957, when the Academy of Agricultural Sciences was established in Peking under the Ministry of Agriculture.[10] Because of the time required for institutional and technological developments, varieties developed experimentally after 1949 received widespread distribution only from 1958 on.

The primary weaknesses of existing varieties of Chinese seeds included a relative lack of responsiveness to the use of fertilizer and water and inadequate disease resistance (although minimal yields were maintained when subject to pathogens). Overcoming these weaknesses became the primary objective of seed development.[11] However, because of the limitations of the Chinese plant hybridization program in the 1950's, there were few immediate payoffs.

Two of the four most widely planted improved varieties in this period were of foreign origin (an Italian wheat and an American cotton variety).[12] However, foreign varieties did not always prove superior under Chinese conditions, and wholesale borrowing was not feasible. Some foreign varieties proved valuable because of their resistance to particular diseases (and thus as breeding stock) and in other instances were hardier than local varieties. On the other hand, some of the more spectacular foreign developments were not viewed as widely applicable in China—high-yielding tropical wheat because of its excessive sunlight requirements,[13] and Japanese varieties of glutinous rice because of their preference for cool climate or high altitudes, a long growing season, and a lack of yield superiority over local varieties except under conditions of unusually high fertilizer use.[14]

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[6] Matsubayashi Minoru *et al.*, eds. *Theory and Practice of Growing Rice* (Tokyo: Fuji Press, 1968). pp. 69–72 and 75.

[7] Chiang Yin-sung, "A Survey Report on the Experimentation, Demonstration, and Promulgation of Kui-hua-ch'ou'," *Chung-kuo nung-pao*, September 1957, p. 27.

[8] Compiled from data in Ting Ying, *Chung-kuo shui-tao tsai-p'ei hsueh* (*Study of Chinese Paddy Rice Cultivation*) (Peking, 1961), pp. 257–61, 269–74, 277–78, 282–84, and 288–90.

[9] Data from Nai-ruenn Chen, *Chinese Economic Statistics* (Chicago: Aldine, 1967), Table 5.101, p. 369, and Table 5.104, p. 370.

[10] Shahid Burki, *A Study of Chinese Communes* (Cambridge: Harvard University Press, 1969), p. 48.

[11] Po Mu-hua, "Origins of the Varieties of China's Crops," *JMJP*, December 11, 1962.

[12] Ts'ai Hsü, "Problems in the Breeding and Promulgation of Good Varieties," *JMJP*, October 9, 1962.

Local selection of superior strains proved moderately effective for some crops, such as rice, but not for others. Locally selected wheat varieties in particular had relatively small scope for application elsewhere. As a result of this, and because of a pronounced bias in selection and experimental cultivation toward high-yield varieties requiring heavy fertilizer and water use,[15] greatest benefits of seed development in the 1950's were concentrated in areas of central and south China which were already advanced.

Work on hybridization began in the early 1950's, but a breakthrough was not achieved until 1956, when Kwangtung rice breeders realized that they had been pursuing the wrong breeding objectives: While they knew that the key to increasing fertilizer response was to strengthen the stalk of the plant (to enable it to bear the burden of more and heavier tassels and grains), their approach in choosing parent stock was to select strains that had tall and strong stalks, large tassels, and large grains. Observing the lodging-resistance of a glutinous dwarf Champa rice variety from Kwangsi, and the practice some farmers followed of deliberate stunting through fertilizer and water control, the breeders apparently became convinced that exceptionally short, not tall stalks should be the key breeding objective.[16]

The first Chinese crossing of a dwarf with a high-yielding variety in production use was accomplished in 1956; and in the same year a nonglutinous dwarf was selected from an improved conventional variety. A third variety was developed from an initial crossing in 1958.[17] Distribution for full production of these and other dwarf rice varieties was begun in 1964 and expanded rapidly thereafter. With adequate fertilizer and water supplies, they offered yields of 6.3 or more tons/hectare [18], and as second-crop rice, more than 4.5 tons/hectare in production.[19] In this and other respects, these varieties were the equal of the IR–8 dwarf rice developed in the Philippines (released in 1966), which launched the "green revolution" elsewhere in Asia. Like the latter, these varieties were initially weak in resistance to some diseases and were clearly superior to the best local varieties only on middle-fertility land with sufficient fertilizer use.[20] Unlike the latter, their growing period of 110 to 115 days was short enough for use in double-cropped rice areas.[21]

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[13] Po Mu-hüa, op. cit.

[14] Ting Ying, ed., *Tao-tso k'o-hsüeh lun-wen hsüan-chi* (*A Collection of Essays on the Science of Rice Cultivation*) (Peking, 1959), p. 13; Chiang Yin-sung, op. cit.

[15] Ts'ai Hsü, op. cit.

[16] Kwangtung Provincial Academy of Agricultural Sciences, "Principal Experience in the Breeding of Dwarfed Paddy Rice," *JMJP*, December 11, 1964, trans. *JPRS* 28, 507.

[17] Li Mei-sheng, "Some Problems in the Promulgation of Dwarf Rice Varieties," *Chung-kuo nung-pao*, February 1965, p. 16; Paddy Rice Scientific Technique Group, Academy of Agricultural Sciences, "Summary of the Characteristics and Cultivation Techniques of 'Kuang-ch'ang' Dwarf and 'Chen-chu' Dwarf Varieties," *Chung-kuo nung-yeh k'o-hsüeh*, January 1966, pp. 28–30.

[18] Li Mei-sheng, *op. cit.*, p. 15.

[19] Chekiang People's Press, eds., *Nung-yeh sheng-ch'an hsüeh-hsi tzu-liao* (Hangchou, 1965), pp. 13, 16. and 20.

[20] The superiority became visible at N-applications above 75 kgs/ha. Li Mei-sheng, op. cit., p. 16.

The success of the new dwarf rice varieties, which today account for 80 percent of total rice acreage in China,[22] proved an important stimulus to plant breeding work for other crops. Work on hybrid maize developed in the 1950's and resulted in the release of double-cross hybrids beginning during the great leap period. These hybrids occupied a large share of total maize acreage by the mid-1960's, but in 1961 and 1966 proved susceptible to disease over large areas. New single-cross hybrids were developed and released in the late 1960's, and acreage in hybrids again climbed to 40 percent of total maize acreage as of 1973. The success of maize breeding efforts has been such that this crop has pushed out much of sorghum and other summer grains in the north, in some northeastern provinces now accounts for 40 percent of cereal land, and in China as a whole ranks after rice and wheat as the third major grain crop.[23]

Wheat breeding work has followed the same pattern as rice breeding, with emphasis on development of high-yielding semidwarfs, primarily of winter wheats. This work has benefited significantly from access to foreign technology: Earlier breeding efforts relied heavily on Italian, Albanian, or Korean genetic stock. Beginning in the early 1970's, China imported some 15,000 tons of Mexican semidwarf wheat seed for direct planting as winter wheat in south China and spring wheat in the north. These trials exposed disease and other problems, so Chinese scientists crossed the Mexican varieties with superior local stock, and the resultant Chinese-Mexican crosses were released from 1973 onward. By 1977, the latter were to be found in production throughout the main winter-wheat producing provinces, as the main varieties south of the Yangtse, and as spring wheat covering 2 million hectares in the northeast.[24]

After initial gains in yields due to introduction of dwarf rice varieties, rice-producing areas have shown much less dynamic production performance than the wheat-maize areas, which benefited not only from seed breeding programs but also from irrigation development discussed below. The political pressure for a new breakthrough must have become severe. It is now claimed that such a breakthrough has occured in the development of male-sterile F1 hybrids of rice, which in 1977 went into the production stage on 5 percent of total rice acreage, more than half of which was in Hunan.[25] The political and technical aspects of this development are unique enough to require a closer look.

Rice and wheat, unlike corn and sorghum, are self-pollinating plants, and this poses seemingly insuperable obstacles to the commercial production of F1 hybrid seed. To make a cross, it is necessary to emasculate the female parent and hand-pollinate, a process complicated by the low pollen viability (as low as 5 minutes with rice) and poor stigma exertion of these crops. To make commercial production possible, it would be necessary to find a genotype possessing male sterility—a very rare genetic characteristic; cross it with "maintainer lines" to produce offspring with male sterility but other desireable genetic characteristics as well; then cross these seeds with "restorer lines" to produce F1 seeds with normal self-fertilizing power. However, the seed propagation process almost certainly requires hand-pollination and even then gives low seed-set (the Chinese currently claim 20 to 22 percent), and consequently low yields per hectare of seed field. To gain a net yield advantage over conventional breeding techniques, the low seed yeilds must be more than compensated for by the crop-yield-increasing benefits of "hybrid vigor." Even though there is no international scientific concensus on the biological wellsprings of "hybrid vigor," outside China there is some doubt whether this characteristic is applicable to self-pollinating plants like rice or wheat, and even greater question whether this could even be a commercially viable process.

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[21] The National Academy of Sciences Plant Science Delegation was told that IR-8 had been tested shortly after its release, but rejected largely because of its long growing period. See their *Trip Report* (Washington, D.C., 1975), p. 53.

[22] *FBIS* Sept. 29, 1977, p. E2.

[23] Unpublished presentation by Li Ching-hsiung, maize breeder from the Chinese Academy of Agricultural and Forestry Sciences, to CIMMYT staff, Aug. 26, 1977; *Tzen yang chung yü-mi* (*How to Cultivate Maize*) (Shanghai, 1976), p. 2.

[24] Statement of Haldore Hanson, Director-General of CIMMYT, to International Centers Week, Washington, D.C., Sept. 13, 1977, unpublished.

[25] The major sources of this and the following information include *FBIS* Sept. 29, 1977, p. E2; *FBIS* Dec. 19, 1977, pp. E13–14; Hunan Rice Research Institute, "The Breeding of Hybrid Rice is a Triumphal Song Composed by Mao Tse-tung Thought," *Chung kuo nung-yeh k'o-hsueh* 1 (1977), pp. 21–26; and reported by recent foreign delegations.

Although all this was well known to Chinese scientists, nevertheless there has been a considerable research effort in this field by both rice and wheat breeders. This began as an apparently low-key search for male-sterile materials, which ended in 1970 when a male-sterile rice derived from a natural cross with wild rice was discovered on Hainan Island (a male-sterile wheat was developed abroad beginning in 1962, and imported to China in the late 1960's [26]). At this point, decisions on the priority or desirability of further research had to be made, and the skepticism of other scientists faced down. These decisions were probably not made on technical or economic grounds—the probability of success would still appear extremely small to any objective observer. But if we may read between the lines, the political and ideological arguments were overwhelming: (1) China has not made any major, independent contributions to agricultural science since liberation, whereas if this succeeded, it would be an achievement of world importance; (2) Marxist-Maoist theory would be hard put to claim that its theoretical underpinnings provide a unique basis for prediction in the physical sciences, but in the case of F1 hybrid vigor, which was explained as a perfect expression of the Marxist-Maoist theory of the unity of opposites, that theory was predicting the superiority of F1 hybrids of rice and wheat in direct contradiction to the beliefs of "bourgeois science" (which also had no acceptable explanation of the natural phenomenon); (3) the male-sterile rice research was developed in Hunan, and its successful completion and application in Hunan would contribute to the prestige of Chairman Hua (under whose provincial leadership it was begun) and his successors in the provincial leadership group, who would like the province to be able to claim preeminance as a model of agricultural development. Thus the provincial party committee gave heavy backing to the research from 1970 on, the Ministry of Agriculture and Forestry sponsored annual national conferences on the research from 1972 on, and in 1975 Hua Kuo-feng and Chen Yung-kuei visited the Hunan Provincial Agricultural Science Academy and issued directives which resulted in the 1977 large-scale plantings (before 1974, there were only 16 kilograms of male-sterile seed in Hunan Province).

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[26] Shantung Province, Laiyang Agricultural College, eds., *Hsiao-mai* (Wheat) (Peking, 1976), p. 214.

Following the discovery of the male-sterile line and its crossing with maintainer lines, the Hunan group searched for appropriate restorer lines, and in 1973 found them in seed "imported from Southeast Asia" (more precisely, several new IRRI lines). Replication of the male-sterile lines and seed production began in earnest in 1974, with the first "large-scale trials" (70 hectares) conducted in 1975. On the basis of these and subsequent trials, it was claimed that F1 hybrids, if used as middle or late crop, offer a 20 to 30 percent yield advantage over nonhybrid varieties, in effect the same claim made for hybrids of all other crops in China. As a result of the 1977 experience, it has been claimed that use of hybrid rice in Hunan reduced the gap between yields of early and late rice from 2.1 tons per hectare in 1974 to 0.75 tons per hectare last year, and resulted in an increase in grain production (although no record) over 1976, despite poor weather (but other crops in Hunan also showed increases in 1977). Does this add up to the beginnings of a new, major improvement of Chinese rice production?

At this stage, it appears that the F1 male-sterile hybrid rice will indeed constitute a major success story. The Chinese estimated an average yield gain of 0.94 tons/hectare in the fields using this variety in 1977, and plan to nearly triple the acreage in 1978 (to circa 15 percent of total rice acreage).[27] But, paradoxically, some questions can be raised about the source of these gains which lead to an even more optimistic conclusion about potential growth of rice production.

First, is it really "hybrid vigor" which gives the F1 hybrids their superiority? IRRI scientists observed Chinese yield trials in which, to be sure, these hybrids were quite productive, but less so than an IRRI variety being used as a check. Moreover, the hybrids are the results of crosses with superior maintainer and restorer lines, notably including other IRRI high-yield varieties, and so would in any case be expected to be productive. Could it be in fact that the F1 hybrids are no more than a quick vehicle for introducing superior genetic stock into varieties already adapted to Chinese conditions? If so, one could expect to see eventual replacement of the F1's with conventional hybrids incorporating similar genes.

If so, the gain would come not only from higher crop yields, but perhaps also important, from higher seed yields: In 1975, hybrid rice seed fields in Hunan produced a mere 0.56 tons/hectare, lower by a factor of nearly 10 than normal seed fields. Had the seed requirements in production fields been comparable to the 100 kilograms/hectare required for better Chinese dwarf varieties, most of the yield gain would have been canceled by the abysmal yields of the seed fields. However, the F1 hybrids turn out to be prolific (high-tillering rate) varieties, requiring only 7.5 to 15 kilograms of seed per hectare, completely offsetting the low seed yields.[28] But this means replacement of the F1 hybrids with, say, a derivative of IRRI varieties of equal or better yield (also prolific varieties) could add 2 percent or more to yields, while saving on labor.

Despite these caveats, the Chinese are unquestionably the first to develop and make profitable use of F1 male-sterile hybrid rice, and the yield gains realized will be crucial to Chairman Hua's call for 4 to 5 percent average annual growth in grain production.[29]

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[27] *FBIS* March 24, 1978, p. E19.

[28] *Peking Review* 9 (March 3, 1978), p. 30.

[29] The growth rate is called for in the new 10-year plan. See *FBIS* March 7, 1978, p. D12.

The extraordinary speed with which hybrid rice went from breeding to full-scale production is the most spectacular example yet of a facility which gives China several years' edge over other countries in the rapidity with which plant breeding results can be applied. In most breeding programs outside the tropics, the time lag between first-cross and large-scale production was and is 8 to 10 years. This lag is dictated by the need in conventional breeding for six or seven generations of crossing and selection work to stabilize the characteristics of hybrid seed, then evaluate it in field trials, and finally multiply the seed, publicize and persuade farmers to accept it. The Chinese have organized a selection system permitting up to three generations per year, usually including one in the province of origin, another in Nan-ch'ang (Kiangsi province), and a third on tropical Hainan Island. The system can also be used to multiply seed rapidly, as in the case of male-sterile rice. This has required adjustment of the cropping schedule (or, for wheat, vernalization) to permit replanting of seeds in successive crop seasons and special techniques to allow for differences in sunlight hours required for early and late crops (e.g., use of special rooms which could be darkened, or of black plastic film for shading). To maximize the seed multiplication rate, sparse planting, high fertilizer use, and continuous or repeated harvesting are employed.[30] Moreover, through the creation of the "four-level research network" (the levels being the county, commune, brigade, and team), China has evolved a system permitting simultaneous stabilization, selection for local adaptability, evaluation, and seed multiplication in the shortest possible time.

However, the need to stabilize characteristics in conventional breeding imposes a lower limit on the time lag required, which has been reflected in the strong research effort under way since 1966 on anther culture (or pollen culture), a means of immediate stabilization after an initial cross. China's success in this area seems primarily due to patient effort in seeking the minor improvements in culture media which raise viability and testing many different genotypes for the applicability of this technique. Inasmuch as several varieties of rice, wheat, tobacco, and other crops developed through anther culture have now been released for test or production planting, cutting four or five generations out of the stabilization process, the prospects are good for a further speedup in the process of applying newly developed varieties.[31]

This is especially significant now that China has entered into active seed exchange programs with international centers such as IRRI and CIMMYT and with programs in individual countries. Although China had previously found ways to import some major new varieties such as IR8 shortly after their release, for the first time it is able to systematically expand its pool of genetic variation (which had greatly narrowed in recent years due to the replacement of traditional varieties with improved varieties possessing narrow genetic bases, and due also to the failure to establish systematic germ plasm collections and thus possible loss of parts of China's genetic inheritance). Moreover, because of the overriding breeding objectives of earliness and yield, Chinese breeders have tended to neglect resistance to insects and diseases as a worthwhile objective. The combination of widespread adoption of new varieties with homogeneous genetic bases and further intensification of the cropping system has, as in other countries, led to buildup of the population of pathogens, and created a perilous situation. Heavy amounts of pesticides and fungicides must be applied to buy time for the breeders, who can now draw increasingly on foreign sources of genetic resistance.

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[30] Kwangtung Provincial Academy, *op. cit.*, pp. 32–34.

[31] The process is based on the culture in nutrient medium of anthers taken from Fl hybrids. See Plant Sciences Delegation, *Trip Report*, op. cit., pp. 125–27; *Kuang-ming jih-pao* December 9, 1975.

FERTILIZER USE

Improved seeds, as was noted above, have had high average and marginal rates of response to fertilizer applications. As such seeds have become available, the need to generate new sources of fertility has become more urgent. Thus, research and extension programs have continuously sought to improve the use-efficiency of existing fertilizer sources, while the production of chemical fertilizer has received an increasing priority in industrial development. Since the rapid growth of the latter is well known, and also is external to the farm sector, I will here consider only the practical innovations in plant and animal husbandry that have made possible an equally remarkable expansion of organic fertilizers.

The traditional level of organic fertilizer use was high, comparable to the roughly 50 kilograms per hectare of nitrogen from organic sources that Japanese farmers used in the early part of this century (but with a higher proportion from animal manure).[32] However, in Japan, as elsewhere, the use of organic fertilizer subsequently declined as a result of the increased availability and reduced price of chemical fertilizers and the replacement of animal labor with machines, which led to decreased supplies of barnyard manure. In contrast, China appears to have expanded the nutrient supply from organic sources by about 41 percent between 1957 and 1971, accounting for about 56 percent of the total increase in nutrient production, despite a rapid increase in chemical fertilizer supply.[33]

The reasons for the emphasis on organic fertilizer growth are quite straightforward: With a cultivated area as large as that of China, it was impossible in the near term to expect increased supplies of chemical fertilizer to satisfy demands for higher levels of nutrient application. Moreover, organic fertilizers are required over the long term in intensive farming to restore and preserve soil conditioning. In addition to organic material and nitrogen, animal and green manures are particularly high in potassium and phosphate content relative to plant requirements. Hence their use permits concentration on nitrogenous chemical production.[34] Phosphates, if applied to green manure crops rather than being used directly, in fact generate their own weight in additional fixed nitrogen (a method the Chinese call "turning the small into the large"). Finally, manure is a joint product of animal husbandry; its economic value contributes to the profitability of meat production.

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[32] Shigeru Ishikawa and Kazushi Ohkawa, "Significance of Japan's Experience—Technological Changes in Agricultural Production and Changes in Agrarian Structure," in Japan Economic Research Center, ed., *Agriculture and Economic Development: Structural Readjustment in Asian Perspective* (Tokyo; J.E.R.C., 1972), p. 146; Shigeru Ishikawa, "Factors Affecting China's Agriculture in the Coming Decade" (Tokyo: Institute of Asian Economic Affairs, mimeo, 1967), Table 12, pp. 60–61.

[33] Thomas B. Wiens, "Agricultural Statistics in the P.R.C.," in Alexander Eckstein, ed., *Quantitative Measures of China's Economic Output* (Ann Arbor; University of Michigan Press, forthcoming), Table 18. Total nutrient applied per cultivated hectare in 1971, including N, P_2O_2, and K_2O, was on the order of 195 kilograms; nitrogen alone, about 93 kilograms (or roughly 65 per sown hectare), compared to 50 kilograms in 1957.

[34] Ch'en Shang-chin, "A Discussion of the Economically Efficient Use of Chemical Fertilizers," *JMJP*, August 27, 1963.

On the other hand, dependence on organic fertilizer has several distinct disadvantages: (1) With organic fertilizers, it is difficult to obtain nutrient proportions that match plant requirements. Since release rates are slow, it is impossible to insure concentrated release at appropriate periods of plant growth.[35] Because of this, and also the bulk of most organic fertilizers, their use (excepting liquefied nightsoil) is confined to base fertilizer, whereas Chinese data indicate that response rates are far higher for top dressings applied at critical phases of plant growth. (2) Overall, at least 20 percent of total agricultural labor time (and often 30 to 50 percent) was absorbed in collecting, processing, transporting, and applying organic fertilizers, which made their use both inconvenient and expensive in areas where there was seasonal labor shortage. Use of chemical fertilizers, which have far higher potency, drastically cuts this cost.[36] (3) Sources of organic fertilizer are involved in a symbiotic relationship with the overall level of agricultural productivity because of land use competition and the successive dependence of manure supplies on numbers of animals, feed supplies, and (closing the circle) fertilizer availability. It is difficult to break out of this "vicious circle" to higher levels of organic fertilizer supply.[37] (4) Production and collection of organic fertilizers takes place at a relatively even rate over time, which doesn't coincide with the concentrated times of application. But storage of organic fertilizers can involve loss of from as little as 20 percent to as much as the majority of usable nutrient, depending on methods used. Moreover, foreign visitors occasionally notice negative crop symptoms which may be due to heavy applications of organic material, plowed into cold soil and inadequately decomposed.

Chinese policymakers have attempted with some success to promote methods of overcoming or minimizing these disadvantages. First, there has been an attempt to insure that available supplies of chemical fertilizers were not used as base dressings, in place of organic fertilizers, but were spread around for use in small quantities as top dressings, even when responsive seeds are involved.[38] To insure that chemical fertilizer would not be substituted for organic, its price has been kept relatively high and its availability carefully controlled. For example, ammonium sulphate sold for about 0.34 yuan per kilogram in 1955, only slightly less in 1964, then fell to the current level of around 0.18 yuan per kilogram as supplies became more ample. The ratio of the price of ammonium sulphate to that of rice has only recently fallen to about 0.9 in China, whereas in Japan it was about 0.33 in 1960, and in Taiwan fell from 1.2 in 1950 to 0.53 in 1972.[39]

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[35] Ibid.; Ch'en En-feng, "The Utility of Inorganic Fertilizers to Agricultural Production," *JMJP*, Aug .27, 1963.

[36] Ting I et al., "On the Problem of Developing Chemical Fertilizers," *JMJP*, Nov. 15, 1962; see also Yen Jui-chen, "On a Few Problems of Raising the Economic Effectiveness of Fertilizers," *Ching-chi yen-chiu* 6 (1964), p. 34.

[37] *Ibid.*, p. 27.

[38] Ts'ai and Wang Pi-chang, "The Road to Raising the Economic Effectiveness of Fertilizer Use as Viewed from Hai-ch'eng Kaoliang Fields," *Ching-chi yen-chiu* 4 (1965), pp. 42–46.

[39] Japanese wholesale prices from the Oriental Economist, *Japan Economic Yearbook*, 1961, p. 178 (a 10 percent retail/wholesale margin assumed); Taiwan barter ratios from H. Y. Chen *et al.*, "Rice Policies of Taiwan," *Food Research Institute Studies* XIV: 4 (1975), pp. 412–13; recent Chinese price quotations from B. Stavis, *Making Green Revolution* (Ithaca: Cornell University Press, 1974), pp. 124–25; *Peking Review* 32–33 (Aug. 9, 1976), p. 26; and the reports of several delegations of the National Academy of Sciences.

On the other hand, rewards paid by the collective to member families for (compulsary) deliveries of pig manure have been in the range 20–30 yuan per pig; at the semiofficial conversion of 30–40 kilograms of ammonium-sulphate-equivalent per pig, this rate must be considered high, although in line with Chinese claims for the use-value of pig manure (the manure of one pig was believed sufficient to produce 100–150 additional kilograms of grain which, at 0.22 yuan per kilogram, would be worth 22–33 yuan).[40] These claims, however, seem to be based on 1950's studies comparing output with and without any fertilizer—that is, average product, which far exceeds marginal product at current use levels.[41] Moreover, the marginal productivity of base fertilizer appears to be well below that of top dressings. Thus pig-raising families are being paid more for their manure than it adds at the margin to total product.

Although the incentive effects of this pricing scheme are interesting, and may explain some of the problems the Chinese have experienced with their pig raising and manure collection policies, the impact on economic efficiency should not be exaggerated. Overpricing of manure to some extent compensates for underpricing of meat by the state (insuring that the "profit is in the manure"). The cost of processing labor is internal to the collective (that is, is simultaneously income to its members) and, to the extent that this labor (conducted during slack periods or leisure time and often by women, children, and old people) has low opportunity costs, these payments have redistributive but little allocative significance.[42] The relatively high ratio of the price of chemical fertilizer to that of foodgrains is less likely to discourage use in China than in other countries, since its use as a supplementary nutrient source and as a high response top dressing imposes little financial burden on the peasantry. Indeed, the overpricing of manure encourages excessive use of chemical fertilizer by cadres concerned with maximizing crop output and/or workpoint value (but not member incomes), but this is handled by rationing. It is, in fact, not uncommon for communes to use chemical fertilizers to break out of a feed constraint on animal raising, in turn permitting subsequent higher levels of organic fertilizer use.[43]

Various methods have been promoted to reduce the impact of the labor cost of organic fertilizer use. These include confining animals to pens (to reduce collecting costs), and delivering manures to the fields well in advance of plowing (to reduce the opportunity cost of labor).[44] Where labor was a serious constraint, green manure was recommended, since the labor cost lies only in the sowing.[45] Women and children are often responsible for collection, and special teams of the aged for processing. While this combination of low opportunity-cost labor and adequate production incentives has promoted a sustained increase in organic fertilizer use to date, and agricultural scientists and low-level cadres alike take it as an article of faith that reliance on chemical fertilizer alone will destroy soil quality, attitudes may change if and when increasing unit value of labor makes the burden of organic fertilizer use too irksome.

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[40] Fragmentary data on compensation for manure from Ministry of Agriculture and Forestry. Animal (Husbandry Bureau, eds., *Ta-li fa-chan yang-chu shih-yeh* (ti-er-chi) (Peking, 1974), pp. 46, 62, 73–74, 80, and 85; *Yang-chu-yeh yao ta fa-chan* (Peking, 1976), pp. 27, 30–31, 38, 47, 65, and 72. On effects on grain production, see for example Liu Jui-lung in *Chung-kuo nung-pao 11* (1957), p. 2: Yen Jui-chen in *Ching-chi yen-chiu* 3 1964), pp. 39–40.

[41] See Thomas B. Wiens, "The Microeconomics of Peasant Economy, China: 1920–40," (Harvard University dissertation, 1973), appendix VI–F, pp. 387–404.

[42] Crop raising and capital construction labor is collective and at least a minimum quota is required to gain access to "basic rations." Pig raising/manure processing labor on private account is, at least in theory, not competitive with labor for the collective.

[43] One model pig-raising hsien tied the supply of chemical fertilizer, to be used on feed land, to the sale of pigs to the state. In lieu of some dramatic increase in agricultural productivity as a source of new feed, a temporary reduction of consumption or sale to the state may suffice.

[44] Yen Jui-chen, *op. cit.*, p. 35.

[45] *Ibid.*, p. 29.

The measures described above on the whole do not remove the difficulty of breaking out of the "vicious circle." This required a major increase in the number of pigs per acre, since the pig was (by 1965) the largest and most efficient source of organic fertilizer (green manure crops were used more efficiently in pig feeding than directly).[46] Yet, despite the care to avoid the destruction of livestock such as accompanied forced collectivization in the Soviet Union, the Chinese were slow to find a mix of policies which would favor growth of the animal stock. In the long run, the policies which evolved have been surprisingly successful: A slow decline in the pig stock was first reversed in 1956, after which numbers of live pigs (115 million at midyear 1957) rose rapidly, then fell (paralleling the great leap harvest figures), but recovered so rapidly that record numbers could be claimed for 1964. By 1972, the midyear stock had reached some 260 million—126 percent more than in 1957, even though the 1972 foodgrains harvest was only some 30 percent larger.[47] Stock growth between 1972 and 1976 has been less consistent, but still has averaged about 8 percent.

In view of the publicity given by the Chinese over the last two decades to improvements in the techniques of animal husbandry, it is tempting to attribute this achievement to technological change, but there is evidence that more mundane explanations will suffice. First, the low rate of foodgrains growth was probably sufficient to sustain the much higher growth rate of the pig stock without major diversion of grain from human consumption, primarily because the growth of the draft animal stock (at 14 percent over 1957–72) fell well below that of foodgrains. According to estimates based on official Chinese data, in 1957 animal feed accounted for circa 21 percent of total production of unprocessed grain (including soy; about 55 percent being the millings and the remainder primarily coarse grains). If this was distributed between draft animals and pigs in proportion to their relative nutritional requirements, then pigs accounted for only 19 percent of feedgrain consumption (or about 68 kilograms per fattened pig).[48] One may easily calculated that, if per capita human and animal consumption remained constant over 1957–72, the total growth rate of feed requirements approximately matched the growth rate of foodgrains production and human consumption. That is, the decline of 15 percent or more in numbers of draft animals during the great leap, slow recovery thereafter, and more recent effects of increasing mechanization on the draft animal stock have freed up sufficient feed to sustain the more rapidly growing pig stock at the same rates of consumption as in 1957.

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[46] *Ibid.*, p. 33.

[47] Wiens, Table IIG–4, in Eckstein, ed., *op. cit.*

[48] The computations are based on the derivation of a foodgrains supply balance for 1953–1957, relating stocks and flows to their major uses. It is assumed that rural non-food use plus the millings of grain used as food in the rural areas, less seed use, approximately equals animal feedgrain consumption. Statistics from Materials Office, TCKT, "The Basic Situation of the Unified Purchase and Unified Sales of Foodgrains in China," *Tung-chi kung-tso* 19 (1957), pp. 28, 31–32; Yü Ku, "The Food Problem of 600 Million People," *Ching-chi tao-pao* 551 (Jan. 6, 1958), p. 9 Nutritional requirements of animals by type based on data in *Nung-yeh k'o-hsüeh t'ung-hsün* 1 (1958), p. 24, JPRS 61, 746 (Apr. 15, 1974), pp. 218–243; *Nung-yeh K'ohsueh t'ung-hsün* 8 (1957), p. 420; and other sources.

The reservation of such feed for animal use, despite other pressing needs, must be credited to state policy, however.

A contributing influence in the growth of the pig stock since the great leap has been a combination of improved management of collective sties and recognition of the essential role of private, sideline pig raising in the total production effort. Private pig raising taps family labor, capital, and food resources which would otherwise be wasted or directly consumed. Although these "surplus" resources are certainly finite and rapid expansion of pig production requires commercialized operations, in which the greater capital and potential returns to scale of collective enterprises are advantageous, the Chinese have included private pig raising among the performance indicators for collective managers, and have provided for the required inputs of feed, breeding, veterinary and insurance services, and slaughtering.[49] Since both the collective and private sectors are conscious of profitability, pig-raising activity has been quite sensitive to price policy—major official price hikes must share the credit for reversal of the decline in pig stock through 1956 and the rapid expansion immediately following the great leap. Since peasants may purchase shoats and feed and sell up to half of their meat production in rural free markets, profitability is not isolated from the forces of supply and demand.[50]

Whatever the magnitude of the residual growth not explained by the foregoing, it may be attributed to technological improvements. These included improvement of breeding stock (which has been concentrated in collective hands, and subject to the infusion of foreign genes, such as those of the Yorkshire pig), reduction of death rates and illness incidence through quarantine, widespread use of antibiotics, etc., and innovations in feeding technique. The last may have been important because, contrary to our assumption above, both the statistical evidence and the logic of increasing commercialization suggest that the "marginal pig" tends to consume more feedgrain than the "average pig." To restrain an upward drift in the requirements for scarce inputs, a constant search for means of increasing the weight gain per unit feedgrain has been underway.

The politically favored solution, since the 1950's, has been the substitution of green or coarse fodders (usually ground-up and fermented leaves, grasses, aquatic plants, stalks, and other vegetable waste) for feed grain ("fine feeds," including millings). This approach, based not on scientific experimentation so much as the "experience of model production units," has been pushed in the press and popular extension literature, and enforced through the guidelines for communal retention and distribution of grain, and through the rationing process.

But earlier Chinese technical literature makes clear that there are severe economic tradeoffs intrinsic to this policy: The Chinese pig in the 1950's was already obtaining little over one-fourth of its nutritional requirements from grain and grain byproducts, on average (but with wide variations in practices). Further substitution of fodder for fine feed, whatever the refinements of fermentation technique involved, might indeed decrease the grain per day required to sustain a pig, but have increasingly marginal effects on the grain requirement per unit weight gain, which approaches a biologically-determined minimum. As a result, the length of time required to fatten a pig to a given weight may, for example, quadruple if a diet of 82 percent fine feed is replaced by one with only 30 percent fine feed, the remainder being fermented greens. Since the rate of turnover in the sty is thus cut by one-fourth, most costs per fattened pig (aside from feed) will also quadruple. (An obvious inference is that the official performance indicator, the number of live pigs in stock, can be increased by switching to the officially-approved technology, at the expense of actual meat production). More damaging, at the price relatives prevailing in the 1950's, feed costs per unit weight gain would be increased by almost 60 percent by the above change in feeding practices, an effect due in part to artificially-depressed official purchase and sales prices of grain and grain byproducts.[51]

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[49] Perhaps to combat the proclivity of lower level cadres to slight the private sector. a rigid set of central guidelines has been promulgated to insure that growth in collective pig-raising would be accompanied by growth in private pig-raising. See Ministry of Agriculture and Forestry, Animal Husbandry Bureau, eds., *op. cit.; Yang-chu-yeh yao ta fa-chan, op. cit.;* and other recent sources.

[50] Ibid. and earlier sources. There were price hikes in 1956 and 1957—see *Chung-yang ho-tso t'ung-hsun* 4 (1959), pp. 9 and 28, following price increases in the early 1960's, the growth of pig raising was so rapid as to tax the capacity of the marketing network and induce the state to reduce prices somewhat. See *Ta-kung pao,* February 20, 1965; *Nung-lin kung-tso t'ung-hsun* 6 (1964), trans. SCMM 429.

Peasants were unlikely to adopt the recommended feeding technology so long as they could either influence the amount of grain and grain byproducts withheld from the state-marketing system or else purchase fine feed in the amounts desired at official prices, hence the state has eliminated these options. Nor could animal husbandry specialists be expected to show much enthusiasm for this technological policy, and indeed the better technical manuals show otherwise-inexplicable internal contradictions in their recommendations on fine feed use. Was this therefore a suboptimal technology from the social point of view? Not necessarily—prices of grain and grain byproducts may be too low and the labor cost of alternative feeds valued too highly to reflect the relative scarcities of grain, grain byproducts and labor from the social (or official) point of view; such nonequilibrium pricing serves redistributional purposes and is not uncommon in other LDC's. Although microeconomic studies of the quality required to verify social optimality have not been seen in China since the early 1960's, Chinese technological policy seems frequently to have been premised on implicit opportunity costs reflecting extreme land scarcity and labor surplus.

But opportunity costs have not been static: Grain and grain byproduct availability has probably increased faster than that of the raw materials required for green and coarse feeds, in part because dwarf or semidwarf crops (with low yields of straw and stalks) have largely replaced earlier varieties, and in part because the waste or scrap land used as a source of fodder has been encroached on by crop cultivation, construction and irrigation works. While this situation will improve immensely when the draft animal stock begins to decline (if this process hasn't begun already), in the meantime it has been necessary to search for new sources of green and coarse feed (often requiring a set-aside of poor quality crop land for this purpose) and ways of making it more palatable to the pigs. In this process, there has been widespread distribution of mechanical fodder shredders, as well as improvements in traditional fermentation techniques.[52] Nevertheless, a survey of the literature on model (that is grain saving) pig-raising units suggests that the level of fine feed consumption has drifted upward over time to perhaps 82 kilograms per fattened pig (20 percent higher than the estimated 1957 average for collective and private pig-raising).[53]

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[51] Quantitative example drawn from recompiled experimental data given in Hsiung Te-hsiao, "How to Raise Pigs and Utilize Feed Economically and Effectively," *Nung-yeh k'o-hsüeh t'ung-hsün* 8 (1957), p. 442 The author, who felt compelled to apologize in advance for "any errors in computations" discovered, in fact made so many errors which served to disguise the implications of his data that one must assume a deliberate attempt to sanitize results undercutting official policy for public presentation.

[52] *Jen-kung liu-wei fa-hsiao ts'u-liao* (*Artificial Stomach Fermented Feed*) (Peking, 1976), describes the current state-of-the-art.

There is a hint of a change in policy on pig-feeding technology within the last few months, signaled by Chairman Hua's call for mechanization of pig raising and the emphasis of a Chinese delegation to the United States on U.S. feeding techniques and products. Mechanization in this case seems to imply not only a more rapid spread of mechanical fodder shredders, but also the establishment of a large number of pig (and chicken) farms in the suburbs of major cities.[54] Since such commercial farms must inevitably rely heavily on commercial (grain and grain byproduct) feeds, it may be that Chinese officials have now conceded that further rapid expansion of meat production (and organic fertilizer) requires the adoption, at the margin, of a grain-intensive feeding technology.

IRRIGATION AND WATER CONTROL

The essence of China's water resource problem is an unhappy contradiction of climate and geography: Of the only 11 percent of China's area that is cultivated, more than half, and by far the best half in terms of soil quality and terrain, is located in north China, whereas south China has largely mountainous terrain and leached, acid soils. But south China, with a warm climate and a long-growing season, also has the heaviest rainfall and about two-thirds of the total surface flow. Because more than half of the country's rainfall is concentrated in 2 or 3 summer months, spring droughts and summer floods are a perennial problem. Annual fluctuations in rainfall are quite severe, especially in the north: In the interior, the ratio of largest to smallest rainfall is 2 or 3 to 1, or more; in the northeast and northwest, it is as much as 10 to 1. Natural disasters tend, therefore, to be much more severe in the north—drought because of a lack of surface water sources and a fluctuating water table, which makes shallow wells an unreliable water source; flood because of a severe erosion problem in the denuded loess soils of the northwest, which has led to a buildup of the bed of the Yellow River to a level well above that of the north China plains and a lack of storage area for runoff during the flood season. As a result of the drought problem, irrigation requirements for secure yields in dryfarming in the north are not substantially lower than they are for paddy in the south.[55]

It is not surprising that the extension of water resources to nonirrigated or poorly irrigated areas should have been the linchpin of Peoples Republic of China agricultural development strategy. As the securely irrigated area grew, it was possible to substitute high-yielding crops and extend multiple cropping, employing improved seeds, more fertilizer, and intensive cultivation techniques to great effect. While this strategy implied a concentration of water resource investment on the areas north of the Yangtse, where high-cost, large-scale programs were required, it was initially believed that returns to such investments would be relatively high.[56]

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[53] Sources include *Ibid.*; collections cited in note 40; Shanghai-shih, Chin-shan hsien, Hsing-t'a People's Commune Revolutionary Committee, eds., *Mo-so kui-lü yang hao-chu* (Shanghai, 1975); and *Chung-kuo nung-yeh k'o-hsüeh* 1 (1977), pp. 88–91, providing twelve observations in all; data adjusted to standard of 60 kilogram pig fattened from weaning to slaughter. The estimated average of 82 kilograms is neither reliable nor necessarily representative, but does imply that even "progressive" units rely significantly on grain feed.

[54] *FBIS*, June 15, 1978, pp. E11–12.

[55] The above based on Ministry of Agriculture, *Nung-t'ien shui-li* (Peking, 1963), pp. 7 and 27.

Initial emphasis, however, was required on problems of flood control and waterlogging, especially in the Yellow, Hai, and Huai River basins. Dikes and embankments needed to be repaired, restored or newly built, and drainage in the low-lying areas adjacent to rivers needed to be improved. Roughly 70 percent of state capital construction funds in water conservancy during the first 5-year plan was spent on these tasks, and only 20 percent on irrigation. Some works however, was multipurpose, and local labor and funds were devoted largely to extending irrigation. By late 1957 it was felt that these problems were basically under control, and attention turned to irrigation.[57]

This judgment was premature, as the large floods from 1959 to 1961 proved.[58] It was later admitted that, for example, of the 27 million hectares subject to flood in the Hai and Huai basins, only half had been "basically" protected by work through 1959; and that in North China as a whole, flood control was generally at a level of protection against once in 5- to 10-year floods, and at twice this level in a minority of areas.[59] As for the problem of waterlogging, the potential seriousness of this problem was greatly underestimated.

Large increases in irrigated area were also claimed during the first 5-year-plan period, along with improvements in the quality of existing systems. The most significant gains were in the north, where 16 of the 18 identifiable large reservoirs completed before 1959 were located. However, most irrigation gains were the product of small-scale works, notably the digging in 1956 of 4.6 million wells, some 40 percent of which were of "good quality." [60] While these were effective during short dry spells, Chinese well drilling and pumping technology were not yet capable of extensive deep-well (over 20 meters) construction.[61]

With Soviet assistance, an expanding Chinese technical cadre had, by 1958, completed draft plans for major multipurpose water control projects on the northern river systems. These plans may have been relatively modest in initial conception, but in the ensuing discussion amidst the fever of the Great Leap, pressure was apparently exerted by local cadres who were anxious for quick breakthroughs, as a result of which the plans quickly became overambitious and unrealistic. At their height, the plans for the Yellow River system alone included 20 dams on the main stream, 90 large and medium dams on tributaries in the middle and upper reaches (the northwest), providing for the irrigation and electrification of 5.7 million hectares (roughly double the 1957 irrigated area).[62] In the lower reaches, where dams were less suitable because of terrain, long-run plans called for the development of an extensive network of interconnected water courses, linking the Yellow River with the Hai, Huai, and the Yangtse, and providing for both irrigation and transportation on a scale comparable to that of the network of water courses in Kiangsu-Chekiang. For Hopei, Honan, Shantung, Anhwei and Kiangsu, 100-percent irrigation was targeted and the canal irrigation in the lower reaches was to be made deep enough to absorb flood runoff, as well as to provide for irrigation. However, the entire water resources of the Yellow River and its tributaries could not meet the projected demands for irrigation in the lower reaches, except at a very thin level; consequently plans called for diversion of water from the Han (a tributary of the Yangtse) and from the Yangtse itself to the Yellow River system.[63]

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[56] For example, the Hui River project proposal anticipated a payback period of less than 3 years—*Chung-kuo shui-li* 4 (1957), p. 22. Such computations often ignored costs borne by the localities, however.

[57] Ishikawa, "Factors Affecting," *op. cit.*, pp. 50–51, especially note 63.

[58] Tojin Sha, eds., *Ajia no Yume* (Dream of Asia) (Tokyo; Tojin Sha, 1964), trans. *JPRS* 32,681, p. 53

[59] Su Tsung-sung, "Eliminating the 'Four Evils' in Order to Develop Agricultural Production in the North China Plain," *JMJP*, December 18, 1962.

[60] Central Intelligence Agency, *The Program for Water Conservancy in Communist China* (Washington, D.C., 1962), p. 14.

[61] *Nung-t'ien shui-li, op. cit.*, pp. 31–33 and 41–42.

[62] Tojin Sha, ed., *op. cit.*, pp. 60–61.

The first-stage construction work on the Yellow River system began in 1958 and continued through 1959, along with the construction of some 60 water gates and extensive major and minor channels on the banks of the lower reaches and the concomitant development of irrigation systems in the Huai basin of northern Anhwei and Kiangsu. Of the immense increase in claimed irrigated acreage of 32 million hectares in 1958, the five provinces benefiting from these projects (Hopei, Honan, Shantung, Kiangsu and Anhwei) accounted for 56 percent.[64] But not long thereafter work was stopped on many of the incompleted projects, the overall plans were shelved, and most of the claimed increase in irrigation "evaporated," probably because many areas had been ordered to stop irrigation.[65] Since this meant abandoning hopes for rapid extension to the north of securely irrigated acreage and high-yield crops, such as paddy rice, and thereby forced a revamping of the entire agricultural development strategy, the reasons for the (temporary) collapse of this program deserve careful examination.

In some part, the postponement of many major projects was due to substitution of small, local projects. This reflected the victory of Maoist development strategy, but also a shortage of cement and steel, which could meet only 20–30 percent of the demands for dam construction.[66] Small local dams could use earth and rock fill with, if necessary, a concrete core or facing[67] and could serve as the first market for the new, small-scale rural cement and steel production.[68] The growing demand for irrigation water (and retention of runoff in local storage facilities) reduced the electricity-generating potential and thus the economic justification of some planned dams below original levels.[69] The policy of simultaneous and uncoordinated development of major and minor facilities, on main rivers and tributaries, which exploited the mass enthusiasm of the moment, was replaced by a more rational bottom-up development policy.[70] The Soviet withdrawal of technical and material aid also doomed some major projects, and the large-scale floods of 1959–61 may have clinched matters by forcing a return to the earlier emphasis on flood prevention, at the expense of irrigation and electricity generation.

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[63] *Ibid.*, pp. 75–77, 79, 87 and 90.

[64] C. I. A., *op. cit.*, pp. 38–39: *Ninmin Chugoku* 6 (1973), p. 23.

[65] Hsiung Yi, "On the Prevention of Soil Alkalization in the North China Plain," *JMJP*, December 18, 1962; Su Tsung-sung, *op. cit.*

[66] Tojin Sha, eds., *op. cit.*, p. 164.

[67] *Nung-t'ien shui-li*, *op. cit.*, pp. 30-31.

[68] C. I. A., *op. cit.*, p. 11. Such a policy is not without drawbacks: The reinforcement of dams to prevent collapse has now become one of the highest priority tasks of capital construction work in the rural areas. See *FBIS*, February 10, 1978, p. E10.

[69] Tojin Sha, ed., *op. cit.*, p. 63.

[70] Su Tsung-sung, *op. cit.*

In addition, two fatal technical errors were made, which might have been avoided through more careful and extensive study. First, the major factor that historically had precluded extensive irrigation in the Yellow River basin was the extraordinary silt content of the river, which has led to an elevation of the bed, the silting of irrigation channels, and consequently to frequent and devastating floods. Soviet and Chinese planners and engineers proposed to deal with the problem both by afforestation in the northwest and by constructing a series of dams from San Men Gorge upstream, which were expected to drastically reduce the silt content downstream.[71]

The afforestation program ran well behind schedule (and today remains far from complete), probably because the northwest is underpopulated and the local benefits of afforestation have been insufficient incentive to mobilize the necessary local labor.[72] Construction of the San Men Dam nevertheless was completed in October 1960, but the effects on silt content in the lower reaches of the river were not significant, apparently because the scouring of banks and beds below San Men Gorge allowed the river to again pickup large quantities of silt. Silt thus continued to clog irrigation works in the lower reaches, which had been constructed on the assumption that this problem would be solved. Consequently, at least one major intake and many smaller channels failed to take in water;[73] moreover, the continued buildup in the river bed, canals, and irrigation channels "became a causative factor in the large floods" of 1959–61.[74]

Second, the serious potential for waterlogging and alkalization does not seem to have been foreseen, largely because there were not enough data on the level of the water table in the various areas that were to benefit from irrigation. Only in discussing the longrun plans for the diversion of Han and Yangtse River water into the Yellow River system was it noted that "there will be the possibility of great increases in ground water in Hopei and Anhwei." Hence systematic study of the problem was advised.[75] But the explosive growth of irrigation in this area during 1958–59, combined with the effects of the 1959–61 floods, led to rapid and drastic elevation of the water table, and thus to potential or actual alkalization of large areas of land.[76]

It is not clear how far this process had gone before a decision was made to stop further extension of irrigation in the Yellow River basin and halt irrigation in some areas where it had already been underway. By late 1959, official policy had shifted from an emphasis on storage to one on drainage, in order to protect against waterlogging and alkalization.[77] By late 1962, some areas had been ordered to stop irrigation, and emphasis had shifted to curing, which was attempted only for newly alkaline land.[78] Moreover, the significance of the problem had been officially elevated to third rank among the four most serious problems of north China agriculture (the others being drought, flooding and silting) and was cited as the main obstacle to rapid expansion of irrigation.[79]

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[71] Tojin Sha, ed., *op. cit.*, p. 83. On the history of the problem, see Joseph Needham, *Science and Civilization in China*, vol. IV:3, pp. 232–45.

[72] Su Tsung-sung, *op. cit.; Ninmin Chugoku*, *op. cit.*, p. 22. As a result, the useful lifespan of the San Men Dam was reduced. On the latest campaign to enlarge afforestation in the northwest, see *FBIS*, Feb. 23, 1978, p. E9.

[73] Su Tsung-sung, *op. cit.*

[74] Tojin Sha, ed., *op. cit*,. p. 53.

[75] *Ibid.*, p. 79.

[76] Egypt, also with Soviet aid, has unfortunately repeated the Chinese error in its Aswan project, but has not yet faced the full consequences. See the *Wall Street Journal*, Sept. 24, 1976.

[77] Ho Chi-feng, "The Glorious Achievements of China's Irrigation Construction During the Last Ten Years," *Shui-li shui-tien chien-she* 18 (1959), pp. 16–17.

[78] Hsiung Yi, *op. cit.*

The forced postponement of the surface water schemes for the north China plain left two feasible lines of attack in the short run: It was necessary on the one hand to deal directly with the problems of drainage and runoff storage to lay the groundwork for resumption of surface irrigation, and on the other to exploit subsurface water sources for irrigation purposes. The former task was inevitably slow and difficult: The terrain is flat, and not only surface flow but also ground water must be drained off. Deep subsurface channels and drainage pipes under the fields were required, and in addition, low-lying fields would have to be elevated, employing the dual-purpose traditional method of removing silt from irrigation channels and rivers and piling it onto fields. The process requires vast amounts of slack-season labor, and peasants accustomed to dry-field cultivation in drought-stricken areas had first to be persuaded that there was good reason to invest considerable effort in order to allow hard-won irrigation water to "drain away." [80] While it might be expected that this process could be speeded up through provision of heavy earthmoving machinery (in the Peking area, land-leveling alone requires 150 to 270 labor-days/hectare without machinery; more than ¥300/hectare with earthmoving equipment), it should be remembered that the opportunity cost of slack-season labor is low and earthmoving machinery damages soil fertility more than human labor by bringing large quantities of subsoil to the surface (reducing yields by 25 to 60 percent relative to hand-leveled land, in the absence of compensating fertilizer, and reqiring 4 to 5 years for recovery even with heavy fertilizer applications).[81] Moreover, the main payoff comes only when the land of an entire district or region is so improved and surface irrigation can be resumed.

It is sometimes suggested by foreign observers that large-scale resumption of surface irrigation in the north China plain is a matter for the distant future, because of the immense costs involved. It should be stressed, however, that the Chinese have been laying the groundwork for two decades, and have invested heavily in this goal; the major question which requires further study is how far they have to go. At this point it seems that major irrigation use of the Yellow River in its lower reaches still awaits resolution of the silting problem, but that diversion of water from the Han and/or Yangtse to the North China Plain will come within a decade. The Tan-chiang-kou project on the Han River, originally intended to divert water to the north, was basically completed in 1969. Of greater interest, though, is the fact that a project for diverting Yangtse water more than 500 kilometers north to irrigate the North China Plain is included within the 10-year development program recently announced by Chairman Hua.[82]

The second line of attack, the use of subsurface water, proved to be an important means for rapidly expanding the scope of irrigation in north China, albeit at a thin level. Surveys in the mid-1960's first determined that reliable, deep-strata water resources existed in this area.[83] The use of subsurface water for irrigation posed less danger than did the use of surface water, since the former only replaced what it had removed from ground water levels.

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[79] It was treated as a minor problem in some areas in Ministry of Agricluture, Propaganda Bureau, eds *Nung-yeh sheng-ch'an chi-shu chi-pen chih-shih vol 14: Tu-jang* (Peking, 1956), pp. 22–23 and 26–28, but as described above in Su Tsung-sung, *op. cit.*

[80] Hsiung Yi, *op. cit.*

[81] Ai Yin-hang and Huang Hung-ch'üan, "The Study of a Few Economic Questions Concerning Land Levelling," *Ching-chi yen-chiu* 3 (1964), pp. 53–54.

[82] *FBIS*, March. 7, 1978, p. D15 and Mar. 10, 1978, p. E8.

What was required were cheap and efficient pumps and drilling technologies. Large-scale production of submersible pumps designed for wells that are more than 30 meters deep seems to have begun in the mid-1960's, and was supported by increasing rural electrification.[84] The well-drilling technology employed, on the other hand, was "improved traditional," that is, human powered but with components of steel plate, pipe, and cable (the process compressed roughly 324 labor-days per well sunk in soft soil into one week of continuous labor). Well linings were made of local handicraft-factory products (such as ceramic, cement, bamboo. sorghum rope, and paper), and were installed in an ingenious fashion.[85] This "package" of product and process, combining minimal but essential inputs from modern industry, maximum use of local semi-handicraft products and labor, and systematized and innovative techniques, epitomizes the "bootstrap" mode of rural technological improvement which has been promoted since the Great Leap.

Moreover, it was successful: More than 1 million such tubewells were installed in north China, accounting for about 7 million hectares of irrigated land—about 70 percent of the increase in irrigated acreage since 1957.[86] Chinese studies suggest that, even in the absence of other improvements, such land yields about 70 percent more in years of drought, and 10–20 percent more even in wet years.[87] Far more important in the long run, irrigation opens up opportunities for a full-scale transformation of local agricultural technology.

However, the utility of tubewells is limited by the availability of subsurface water in adequate quantities outside the North China Plain, and especially in the more mountainous regions, ground water supplies are less ample and less accessible. Moreover, both ground and surface water irrigation schemes can be stymied by the expense or impossibility of lifting and distributing water among dispersed, tiny, terraced plots. In these conditions, which characterize many parts of interior China, the optimal solution may be the introduction of spray irrigation, which saves water, labor, and the land absorbed by canals, ditches, and furrows in surface flow systems. Spray irrigation has only recently begun to develop in China, perhaps because it requires fuel-efficient pumps and reductions in cost of pipes or tubing and nozzles. However, the rapid expansion of spray irrigation has now become a high-priority goal of current mechanization policy, and is especially pushed for mountainous provinces such as Szechuan where the introduction of more intensive cropping systems has long been blocked by the inability to extend irrigation.[88] Since the laggard performance of a number of such areas has acted as a drag on the overall performance of the entire agricultural sector, this development could prove as important as the spread of tubewells in north China. In areas with already developed surface flow systems (excepting paddy-producing areas), spray irrigation may permit recovery of some land currently occupied by water distribution channels, and help stretch available water resources, at the expense of the more severe pest problem intrinsic to this form of water delivery.

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[83] Jack Chen, *A Year in Upper Felicity* (New York: Macmillan, 1973), pp. 209–212.

[84] The state of pump technology through 1965 is described in Ministry of Agriculture, *Nung-t'ien shui-li* op, cit., pp. 31–71; *Chieh-fang jih-pao.* July 20, 1965.

[85] The well-drilling process and technology are described in Jack Chen, *op. cit.*, pp. 215–20.

[86] Wiens. *op. cit.*, pp. 118–19.

[87] Liu Pai-t'ao, "Basic Research on the Economic Efficiency of Irrigation," *Ching-chi yen-chiu* 8 (1964), p. 30.

[88] *FBIS*, Feb. 10, 1978, p. E10; Feb. 24, 1978, p. J3; British Broadcasting Corp. *Summary of World Broadcasts*, Jan. 25, 1978, p. A6.

MECHANIZATION

The optimal pace and forms of farm mechanization have been the subject of considerable controversy since the inception of the People's Republic, although the issue remained largely academic until the production capacity of the machine-building industry reached significant levels (after the Great Leap). On the one hand, mechanized farming, as practiced in the Soviet Union or the United States, symbolized modernity and the elimination of the distinction in technique and psychology between farm and factory labor.[89] On the other hand, introducing machinery at an early stage of agricultural development might save labor without concomitant increases or even with a decrease in land or capital productivity. It was accepted as a general principle that China should develop and produce machinery that would contribute to all three measures of productivity and that labor-saving machinery should be introduced only where released labor could be used profitably to intensify cultivation, open or improve land, repair water works, or increase sideline activities.[90]

Of a variety of mechanizable farming activities, plowing seemed to offer the greatest potential for economically justifiable innovation. It has been argued that improvements in the traditional Japanese plow made during the late Meiji period were a prerequisite to the takeoff in fertilizer usage which contributed so much to subsequent growth in Japanese agricultural productivity.[91] While the significant improvement in the Japanese case was due to the increased depth of plowing (permitting better developed root systems and thus more fertilizer-absorption capacity and less tendency to lodge), in the Chinese multiple-cropping regimen the potential labor savings were also significant because of the time pressures on the labor supply in the short period during which harvesting, plowing, and sowing or transplanting had to be done in succession.[92]

The traditional Chinese plow, like its Japanese counterpart, was light, small, simply constructed, and cheap due to its minimum metal requirement (¥12 for dry field; ¥4.67 for paddy plow), but it required considerable human and animal effort, plowed to an average depth of only 4 to 5 inches, and did not turn over the soil well. Beginning in the early 1950's, the Chinese began producing and distributing on a large scale various improved traditional plows, characterized by enlarged share and moldboard and, on some dry-field plows, the addition of a guide wheel. These implements increased average plowing depth to 6.5 inches and significantly reduced the labor requirement per hectare (by 40 percent for dry field and 17 percent for paddy plows), at the expense of a substantial increase in unit cost (to ¥21.70 for dry field and ¥14.84 for paddy plows).[93] Still, the investment was small relative to the value of labor savings, and these plows were evidently well received.

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[89] Chinese admiration for mechanized farming is well reflected in William Hinton, *Iron Oxen* (New York, Vintage Books, 1970).

[90] Hsiang Te, "A Discussion of the Problems of Mechanizing China's Agriculture," *JMJP*, July 2, 1963.

[91] Takekazu Ogura, ed., *Agricultural Development in Modern Japan* (Tokyo: Fuji, 1967), p. 370.

[92] For further discussion, see Kenneth Walker, "Organization of Agricultural Production," in A. Eckstein W. Galenson, and T. C. Liu, eds., *Economic Trends in Communist China* (Chicago: Aldine, 1968), pp. 405–13.

While the improved traditional plow was a product of handicraft industry, modern industry showed its willingness to serve agriculture by producing large numbers of double-wheel, double-share (abbreviated DWDS) plows, which were copies of Soviet and Polish models best suited to dry field cultivation, but adaptable to paddy conditions.[94] This animal-powered, all-metal implement was far more costly than traditional or improved plows (initially ¥90).[95] Yet, even if one accepts advertised capabilities, it is not clear that the DWDS plow was superior to the improved plow, except in working difficult or unbroken soils, where the greater weight would count in its favor. The depth of plowing was comparable, if more even; the greater breadth of furrow (and hence speed) was offset by the larger pulling requirement—two or three animals, as opposed to one or two for the improved traditional plow.[96] Still, in plains areas with well laid out fields and adequate numbers of labor animals (or a shortage of human labor), the greater speed of plowing and the durability of the implement were advantageous. Moreover, continuous price reductions (to ¥61.50 in 1956, ¥27.30 in 1974 [97]) expanded the market, and the fact that the plow is still produced today attests to its ultimate profitability to at least some north China purchasers.

Nevertheless, promotion of the same plow for use in paddy cultivation in south China proved to be one of the major blunders of Chinese agrotechnical policy. In 1956–58, a vast number of DWDS plows were produced for this purpose, but rice-growing peasants reacted negatively to them. Inventories at distribution centers piled up, and many plows that were sold were later returned unused. In fact, the 40-percent price reduction in 1956 was a direct reaction to the resulting surplus stock (and, ironically, accounts for much of the improved terms of trade of the peasantry during the first 5 year plan).[98] While this mistake in policy has commonly been attributed to blind commandism or technical stupidity, these explanations will not suffice.

There were strong political reasons for promoting the DWDS plow: The policy of promoting rapid cooperativization from 1956 on made it necessary to demonstrate to the peasants that the collective organization could improve their livelihood substantially. This could result from the use of the large-scale collective labor force, as in the irrigation projects discussed above, or from the larger accumulation of funds, making more expensive capital equipment accessible for the first time. But at the time the DWDS plow was virtually the only expensive capital item that could be produced and distributed in quantity (tractor production began only in 1958). Thus, if benefits could be demonstrated, there was reason to produce and promote this implement.

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[93] Price averages, descriptions, and technical characteristics of plows tabulated by the author from PRC, Ministry of Agriculture, *Nung-chū t'u-p'u* (Peking, 1958) and 2d Ministry of Light Industry, Agricultural Implements Bureau, *Nung-yeh chi-chū ts'ung-shu*, vol. I (Peking, 1966). On improved implements, see also Amano Motonosuke, "Daiyakushin ki no nōgu," *Ajia Keizai* 14: 12 (1973).

[94] Ministry of Agriculture (1958), op. cit., pp. 25–27.

[95] Central Intelligence Agency, *Prices of Machinery and Equipment in the P.R.C.* (Washington, D.C.: 1975), p. 14.

[96] 1957 claims indicated labor savings of 28+ percent, but 1964 materials indicate no labor savings (human plus animal) at a ratio of animal-to-human labor cost of 3 to 1. See Ministry of Agriculture, *Nung-yeh chi-chū* (Peking, 1964), p. 40. An article in *JMJP*, June 16, 1958, suggested that, with only two or weak animals, the DWDS plows could hardly plow more deeply than even traditional plows.

[97] Central Intelligence Agency (1975), op. cit., p. 14.

[98] See *JMJP*, Oct. 7, 1955 and Feb. 5, 1958.

Experiments in paddy cultivation in 1954–55 did convince the leadership that the DWDS plow could be beneficial, but they erred on the side of optimism in extrapolating from experimental to field conditions: (1) The traditional paddy plow required one buffalo, whereas the DWDS plow required two. Animals had to be trained to "cooperate," and plowmen to manage them. (2) In theory, the DWDS plow required less pulling power than did two traditional plows, but this was not the case in practice. Pulling requirements could be reduced by modifying the DWDS plow, but initially, these modifications were left to the purchasers to make. (3) Paddy fields in practice proved too short for efficient use and the paths between them too narrow to transport the plow. It was optimistically assumed that cooperativization would induce peasants to modify these conditions but the costs involved apparently were not considered. (4) Efficiency improved with use and training: Plowmen who were new to the implement were discouraged when they could not reach the rated speed of plowing. (5) The economic efficiency of DWDS plows was predicated on labor shortages that were expected to result from a rapid expansion of multiple-cropping and fertilizer collection efforts. These changes in technique were not realized in the short run.[99] (6) Without modification, the DWDS plow could be used only on a hard-pan paddy, and not in mountainous areas, terraced fields, or muddy (i.e., marshy) fields, nor in areas where animals were scarce. This eliminated, for example, some 55 percent of the cultivated acreage in Chekiang. (7) The experimental results implied increases in yields of more than 14 percent over those due to plowing with traditional plows, but in large-scale comparisons in field conditions, the average increase fell to 5 percent.[1]

While many of these problems could have been eliminated eventually, it is still true that the DWDS plow offered at best only limited labor savings[2] and a decreased (although more even) depth of plowing compared to the improved paddy plow, despite the much higher cost of the former. In combination with the loss (or decreased strength) of animals and shortages of steel as the Great Leap collapsed, this probably doomed the promotion of this implement for paddy use. By the time recovery was complete, China was in a position to move on to a more advanced stage of mechanization of rice cultivation.

In view of the high opportunity-cost of maintaining or expanding the draft animal stock (in terms of grain or meat consumption sacrificed), the direction of advance could only be toward tractorization, but at first this did not seem feasible for paddy cultivation. To be sure, 25–35 horsepower tractors could be modified for use with reasonable efficiency in hard-slab paddy fields if the field size was enlarged to about two-thirds of a hectare per plot,[3] but these conditions, as well as cost considerations, restricted applicability to a small percentage of the acreage in the mountainous south.

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[99] *JMJP*, Feb. 5, 1958.

[1] *Ibid.*, and *JMJP*, Jan. 26, 1958.

[2] My calculations imply none at all at a 3:1 ratio of animal-to-human labor cost. Figures drawn from Ting Ying (1961), *op. cit.*, p. 632.

[3] *Ibid.* pp. 626–27.

In response to similar needs, by the late 1950's, rotary power tillers were being produced and distributed in Japan, and China was quick to test their applicability. The initial conclusion was negative, even though labor productivity was three times as great as when the traditional plow was used, quality of work was considerably higher, and the time utilization rate was quite high regardless of the size of the field. The reason for the rejection was clear: Increased plowing depth was considered crucial to the yield-increasing strategy of the Chinese, yet the power tiller cultivated to a depth of only 5 inches on average—just slightly better than the traditional paddy plow and worse than the improved paddy plow (4 and 6 inches, respectively).[4]

Attitudes toward the power tiller changed in the 1960's, however, and by 1966, production was being rapidly expanded; indeed, the spread of the power tiller has been the most notable feature of Chinese tractorization ever since.[5] The policy reversal reflected a further emphasis on increased multiple cropping in the south, even at the cost of loss of yields due to a reduced depth of plowing.[6] Double or triple cropping of rice created an overwhelming labor time constraint, which made economical not only the power tiller but also, in a very few areas, the mechanical transplanter, an indigenous innovation that also supposedly saves labor time without directly contributing much to yields.[7]

The change in attitude toward the power tiller should not be seen as a correction of a previously erroneous policy, however, but rather as the result of a relaxation of the constraints limiting the expansion of multiple cropping in the 1950's, due to the development of seeds with shorter growing seasons, increased fertilizer supplies, improved means of water control, and better organizational techniques. Under these changed conditions, a sacrifice of some plowing depth may be economically efficient.

Despite the rapid growth of the tractor park (for example, Shantung, a relatively advanced province in mechanization, had one tractor for every two brigades by 1974, and hopes to double this ratio by 1980),[8] it is a curious fact that foreign visitors observe tractor cultivation more frequently in the paddy fields of the south than in the dry fields of the north, and in both areas, animal plowing will be seen in the fields even while many tractors are engaged in transport work on the roads. It might be surmised (on the "peasant knows best" theory) that transportation is a more serious production bottleneck (or greater source of profit) than plowing, that is, that tractors can make a greater indirect contribution to yields by freeing labor and draft animals absorbed in moving inputs, crops, and people during the critical crop turnover period than by direct use in plowing. But if this were so, why is the Chinese Government currently chastising communes and brigades for this practice, and forcing them to get the tractors back into the fields? [9]

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[4] *Ibid.*, p. 628; Matsubayashi Minoru *et al.*, *op. cit.*, pp. 382–85. One pass with a power tiller is equivalent to one plowing and two harrowings with traditional implements. But power tillers are also restricted to hard-slab paddy fields.

[5] Central Intelligence Agency, *Production of Machinery and Equipment in the P.R.C.* (Washington, D.C., 1975), p. 10.

[6] Although once-a-year deep-plowing with draft animals or large tractor is still possible.

[7] The first transplanter was invented by a Hunan peasant youth in 1958; models approved for widespread manufacture in 1960 were experiment station products, however. These machines, which apparently are not very reliable, at best improve slightly on yields through more consistency in density, orderliness, and depth of transplanting—see Ting Ying (1961) *op. cit.*, pp. 638–42. It is also relevant that they save female, not male labor. Transplanting has not yet been mechanized in Japan, probably because limited multiple cropping imposes no serious time constraint.

[8] *FBIS*, June 2, 1977, p. E3.

A more plausible explanation is that this is a consequence of the separate ownership of tractors at administrative levels higher than the production team, and the state-fixed price at which the plowing services are provided to the teams: Brigades are simply acting as income-maximizing enterprises, to the detriment of the incomes of "member" teams, by using their tractors in work the revenues of which are not limited by the state. Nor is it the only example of a resource allocation problem arising from the hierarchical (and undemocratic) structure of the commune, in which the state has now been forced to intervene in the interests of agricultural production, which is controlled by the team level.[10]

IMPROVED TECHNIQUES

Of all the agricultural practices recommended in the national agricultural development program, the only one that represented a break with trends in technique elsewhere in Asia was the promotion of "scientific close planting," which once was described as the "main theme" of the technical reform program.[11] While many other aspects of improved technique have proven more important in the long run, the origins, evolution, and eventual fate of this innovation are particularly illuminating to our topic.

The emphasis on greater plant density as a yield-improving technique may derive from Soviet advice and, more specifically, the theories of Lysenko. The latter believed in the lack of intra-species competition, and the advantages of numbers when one species was in competition with another (e.g., crops against weeds). Thus he argued for dense planting. Although, in the Soviet Union, the method and its most famous application (to tree planting for shelter belts) were attacked as failures as early as 1954, these attacks were suppressed by political supports of Lysenko.[12]

Emphasis on increased plant density in China cannot be explained entirely by Lysenkian Soviet advice, however. Chinese experiments did establish that, in conjunction with deep plowing, increased density not only increased yields, but also significantly raised the marginal response to nitrogen applications (with existing seed varieties).[13] The explanation was roughly that deeper plowing and increased fertilizer applications made possible greater vertical root development, thereby permitting closer planting without the decrease in yields that would otherwise result.

Unfortunately, as in the Soviet Union, this change in technique captured the imagination of political cadres, who appreciated the analogy between the "collectivist nature" (*ch'ün-t'i-hsing*) of plants and the process of communalization, the apparent refutation of the "bourgeois" law of diminishing returns, and the seeming requirements only of labor and additional seed to implement this reform. In the fever of the Great Leap, the reform was pushed on reluctant peasants with the same "excesses" that caused the debacle in local irrigation work or the promotion of the DWDS plow.[14] For example, the traditional rice planting density in Kwangtung Province was less than 1.5 million seedlings/hectare and differed little from traditional standards elsewhere in Asia.[15]

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[9] See FBIS, March 15, 1978, p. H3; Feb. 10, 1978, pp. E11–12.

[10] See, for examples. *FBIS*. Feb. 17. 1978, p. E12; Feb. 16, 1978, p. H4.

[11] Asakawa Kenji, "Four Reforms in Chinese Agriculture," *Chugoku Kenkyu Geppo* 154 (Jan. 30, 1961), trans. JPRS 9209, p. 43.

[12] Loren Graham, *Science and Philosophy in the Soviet Union* (New York: A. Knopf, 1972), pp. 237–39. Lysenkian doctrine reached China in the early 1950's, where, as in the Soviet Union, it was used to attack theoretical research and promote practical research inspired by advanced peasant practices. See Fang Ts'ui-nung, "The Road of Service to Agricultural Production by Agricultural Scientists," *Hsin chien-she* 3 (1954), p. 18.

[13] Ting Ying (1961), *op. cit.*, pp. 369 and 372, presents experimental results demonstrating these points. Existing seed varieties presumably had low tillering rates.

But by 1958, this density had been increased by about 50 percent, and with the promotion of this and supporting reforms as the basis for the Great Leap in time for the fall planting, density reached 6–7.5 million seedlings/hectare—higher in some localities. For 1959, the Kwangtung CP Central Committee advocated a further increase to 12–15 million per hectare.[16]

A severe economic loss was the only clear result of these "excesses." According to one post mortem, an increase in seedling density from 2.3 to 7.5 million/ha did increase yields, but only by 180 kilograms. However, the increased yield was almost canceled by the increased seed requirement of 150 kilograms. Moreover, additional land had to be reserved for seedbeds (at the expense of both preceding and current crops), added labor was required for their preparation, transplanting and care, and heavier applications of fertilizer were required.[17] (The reader may note the parallels and differences between this case and that of F–1 hybrid rice discussed above.)

With the experts again in command, promotion of "scientific dense planting" was subtly modified to a "reasonable range of density" (*ho-li mi-chih*) and deemphasized. Had the course of Chinese agrotechnical development followed those of other Asian countries, recommended density could then have been expected to decrease. For example, in Japan "there has been a gradual tendency for the density of planting rice . . . to decrease as the quantity of fertilizers used has increased and as rice varieties of a more prolific type have become common.[18] That is, seed selection and cultivation emphasized the development of plants bearing a maximum number of tillers (grain-bearing offshoots of the main stalk) per seedling. This trend of course saved both seedbed area and labor expended in transplanting. Thus, by the 1950's, standard density in Japanese rice cultivation was down to only 0.84 million seedlings/hectare.[19] Improved row planting methods in the Philippines were said to reduce density to 0.99 million/hectare; experiments with IR–8 seed in west Pakistan showed that a density of 0.87 million/hectare gave highest yields.[20]

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[14] The volume of propaganda "refuting" local opinions concerning plant density is a good indication of the extent of peasant resistance. See Kenneth Walker in Eckstein et al., eds., *op. cit.*, p. 421; Ministry of Agriculture, Foodgrains Production Bureau, *1958-nien nung-tso-wu mi chih ching-yen* (Peking, 1961).

[15] *Ibid.*, p. 5. Density in the Philippines was traditionally about 1.3 million seedlings/ha, according to unpublished IRRI materials.

[16] *Ibid.*, p. 5.

[17] 2.25 million seedlings resulted in 2.85 million effective ears, at 64.24 grains/ear: 7.5 million seedlings led to 5.85 million ears, but only 32.58 grains/ear and with a 10 percent decrease in weight/grain. 0.66 kilograms of seed were required to produce around 10,000 seedlings. Ma Chien-yü, "The Group Concept in Agricultural Production," trans. JPRS 9,398 (Mar. 23, 1961).

[18] Takane Matsuo, *Rice and Rice Cultivation in Japan* (Tokyo: Ministry of Agriculture and Forestry, Government of Japan, 1959), p. 127.

[19] *Ibid.*, pp. 127 and 164.

[20] Philippines datum from unpublished IRRI materials (1968): Pakistan from Agricultural Department, Government of West Pakistan, *Annual Report on Accelerated Rice Research Program* (1966), table 7, p. 31.

However, in the midsixties, Chinese experts were still recommending densities in the range of 2.25–3.75 million seedlings/hectare for rice, citing studies documenting that the point of maximum yields lay within this range.[21] Recent delegations of foreign agricultural scientists continue to be surprised to find densities far higher than are favored elsewhere.[22] Since, in response to the Great Leap excesses, the question of optimal density has received careful and extensive study by Chinese agronomists, the difference in technique is likely to be purposeful.

Several reasons can be cited to explain the greater density levels promoted in China: First, in attempting to explain decreases in yield resulting from excessive density, Chinese scientists determined that the major problems were a reduction in the amount of light reaching plants and reduced air circulation which affected the microclimate. Optimum spacing, row arrangements, and fertilizer application timings were found to reduce the impact of these problems, thus permitting higher density levels.[23] Second, Chinese research concluded, contrary to previous doctrine but in accordance with foreign findings, that density should be inversely proportionate to fertilizer use (because, with low fertilizer use, it was necessary to rely on the main stalk and neglect subordinate spikes). However, the levels of fertilizer use considered high enough to justify low density were on the order of 225 kilograms of nitrogen per crop hectare from all sources, far above average application levels anywhere in the world. Hence these findings do not really account for the difference between Chinese and foreign density levels.

The only convincing scientific justification is that dense planting is another corollary of the emphasis on fast crop maturation, which in turn is dictated by the emphasis on multiple-cropping and, in some northern areas, by the short length of the growing season. Under sparse planting, the main and subordinate heads develop at slightly different rates, and the ripening process is thus stretched out. Suppression of tillering and reliance on the main head, through dense planting, contributes to uniform rates of maturation, and reduces the length of the ripening stage.[24]

It is possible also that the process of seed selection and hybridization, carried out in China with high yield under dense planting as the major objective, has led to the development of seeds with a different response to high density than those developed elsewhere under broader objectives. Should seeds of foreign parentage come along which possess high yields, adequate earliness, and a high tillering rate, this technological "expansion path" may be quickly abandoned. This in fact seems to have happened in the case of F1 male-sterile rice, which is only advantageous because the density (and seed requirement) is one-tenth of the Chinese norm.

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[21] Ministry of Agriculture, *Shui-tao tsai-p'ei* (Peking, 1965), p. 30; T'ang P'ei-sung, "Raising Unit Yields Through the Efficiency of Plant Utilization of Light," *JMJP*, Nov. 12, 1963.

[22] See for example National Academy of Sciences, Plant Studies Delegation, *op. cit.*, p. 45.

[23] Ministry of Agiriculture, *Nung-yeh ch'i-hsiang* (Peking, 1963), pp. 24–25.

[24] Kuo I-hsien, "On the Principles of High Yields in Paddy from the Perspective of Group Structure," *JMJP*, Apr. 9, 1963.

CONCLUSIONS

A common strategic objective underlies the entire program of technological change in Chinese agriculture, specifically the increase in the extent of multiple cropping. In comparable environmental circumstances, where other countries are growing a single crop per year, China seeks two; where others grow two, China seeks three. The impact of this goal on the forms and directions of technological change in Chinese agriculture cannot be exaggerated:

Multiple-cropping dictates extreme earliness as an overriding objective of Chinese seed breeding, at a cost of potential yields and ease of borrowing from foreign breeding programs. Multiple-cropping makes an available supply of organic and chemical fertilizers, which is now becoming adequate by the standards of a modern, single-cropping system, inadequate to satisfy the requirements of two or three crops, so that one or no crops can reach optimal yields. It also necessitates the absorption for the foreseeable future of large quantities of labor in low-productivity collection and processing of organic fertilizers, exacerbating the labor-productivity gap between agriculture and industry. Multiple-cropping increases the water requirement in Chinese agriculture, forcing further development of artificial irrigation in areas where rainfall or existing irrigation systems are adequate for only one or two crops, at a significant cost in capital, labor and land encroached on by the irrigation systems. Multiple-cropping creates the bottlenecks in labor and draft animal supply which make mechanization a prerequisite for further intensification, rather than a means of sustaining farm production with a decreased labor force as in other countries. It also forces the continued maintenance of a huge draft animal stock, which reduces grain available for human consumption or meat production. Multiple-cropping, through its requirement of earliness, creates the need for dense planting, whereas other countries have tended to reduce labor and seed production requirements through sparser planting with no loss in yields.

In view of the severe costs of increasing the multiple-cropping rate, one would hope that the benefits clearly outweighed those of alternative strategies. Unfortunately, I have seen no evidence that the Chinese have considered any alternatives at least since the 1950's, even though changing technologies may have made earlier appraisals of limited relevance. By now, the efficacy of multiple-cropping has become a matter of doctrine, at least at the official level.

The most plausible alternative would not have been single-cropping, except in the north, but rather a maintenance of the status quo ante. a system of double-cropping south of the Yangtse River (rice-rice in the warmer areas, winter wheat-rice otherwise), and intensification of production within that constraint. Based on the experience of other countries and the costs and difficulties experienced in changing this system in China, this would have been the natural course of development, in the absence of forceful state intervention. A rigorous comparison of the costs and benefits of the two alternatives, particularly in the light of technologies available outside China, would require quantitative data of a sort not readily obtainable, but the following argument against further increases in the extent of multiple-cropping can be made:

Under conditions of optimal management, geographical units as large as a county today can at best obtain annual yields as high as 10.5 tons per hectare (more commonly, 7.5 tons/ha) using a three-crop wheat-rice-rice system. While this is quite impressive, it represents yields per crop averaging only 3.5 tons per hectare, which is not unusual by the standards of advanced technology abroad (e.g., in Mexico or the Philippines) or in China. At the latter standards, it should be possible to commercially produce 3–4 (or even 5–6) tons per hectare of winter wheat and 7 or more tons per hectare of rice giving, in a double-cropping system, 10–11 or more tons per hectare annual yield. Moreover, the latter would presumably be obtained with equal or lower amounts of inputs, and without creating the severe time bottlenecks of the triple-cropping system. Instead of making a premature switch to triple-cropping, therefore, why not invest the extra labor and capital in better management within the double-cropping system (or single-cropping in the north), with the same potential gain in yields?

If one can imagine a Chinese response to this reasoning, it might be stressed that brigades, communes or counties which switch to a more intensified cropping system typically do so when the potential for further productivity growth under the previous system has been largely played out, and then do so voluntarily. For example, foreign observers have found Chinese officials and scientists enthusiastic about further extension of triple-cropped rice in Kwangtung, but found local cadres and peasants still unwilling to switch. Also, although the adoption of a new pattern may well be "sweetened" by provision of additional or subsidized inputs which insure a local gain in output over the old system, it is not necessary from the social point of view that the new system provide immediate economic advantages, merely that it opens a road to genuine long-run gains. A short-run social loss, if necessary, may be regarded as an investment permitting long-run social gains. In this regard, the case may be mentioned of a model farmer who in 1954 was getting 10.5 tons per hectare from a double-cropping system; today this yield is achieved on large areas in the same region, which has now switched to triple-cropping; model farmers today are getting well over 20 tons/ha on experimental plots under triple-cropping, yields significantly beyond the current commercial potential of the double-cropping system. Once the switch is made, therefore, the process of converting potential into actual gains is stimulated by the new bottlenecks encountered which account for the gap between experimental and commercial yields.

The Maoist optimism or blindness toward risk of this response, however tempered by gradualism, is a striking characteristic of the Chinese implementation of technological change in agriculture, and helps explain both the outstanding successes and failures of their technological policies. It ignores or denies the risk that experimental yields cannot ever be attained economically in commercial production, that the bottlenecks may never be removed, and that premature adoption may lead to serious economic losses before this is understood. However, the failure of the technological policies of the Great Leap was so devastating that ever since the risks have been kept within acceptable levels through the emphasis on experimentalism, gradualism and voluntarism.

Chairman Hua Kuo-feng has been more intimately involved in the promotion of technological change in Chinese agriculture than any other highlevel leader except Chen Yung-kuei, and this involvement has encompassed the failures of the Great Leap technological policies as well as successes in irrigation and seed development work in recent years, yet his optimism about further potential is as striking as the 4–5 percent growth target he recently announced. Although this paper has stressed historical developments, we have also assessed the innovations "in the pipeline" which, together with better exploitation of existing potential and further increases in industrial inputs, must provide the material basis for attaining that target. In seed development, for example, introduction of semi-dwarf wheat seeds incorporating the best foreign genetic stock has been so recent that the high and accelerating growth rate of wheat production over the last decade may continue for some time (wheat output grew 64 percent between 1969 and 1976).[25]

In the rice region, it now seems very likely that there will be a breakthrough in stagnant yield levels through use of F–1 male-sterile hybrids. Attention has also turned to low-yielding foodgrains such as soybeans which have imposed a drag on production increase, and to the breeding of entirely new crops such as triticale which are intended for low-productivity regions.[26] Seed stock will surely benefit from China's new involvement with international seed breeding programs, especially through the introduction of pest-resistant genetic material. And through such techniques as anther culture, use of F–1 hybrids, and rapid stabilization, testing and distribution of new seeds, any potential can be realized within 3 to 4 years after its recognition. On the other hand, the rush to meet yield-increase targets is certain to increase genetic uniformity, and thus the hazard of major crop disasters due to the genetic susceptibilities of the seeds employed.

Fertilizer use will have to continue to grow rapidly to meet the nutrient requirements of the new seeds. It will be met not only from new chemical fertilizer production capacity, but also from the manure which is a byproduct of the planned expansion of pig raising. The replacement of draft animals through mechanization and the evident commitment to more grain-intensive feeding techniques should provide the basis for more rapid growth of pig numbers. The new emphasis on phosphate production should also be mentioned, since it is of benefit both to those red-soil areas in the South and Southwest which have insufficient sources of organic fertilizers and to soybeans in particular, which respond best to that nutrient.[27]

One may also look to major breakthroughs in irrigation in the next decade. The introduction of sprinkler irrigation on a large-scale trial basis in Szechuan is the first step, and can be expected eventually to narrow the gap between yields in the mountainous areas and those in the plains; those provinces which stand to benefit most are the lagging interior and southwestern rice producers. A more dramatic development will be the planned realization by 1985 of the dream of irrigating the north China plain with water from the Yangtse. The commitment to production of more earth-moving machinery for use in farmland improvement and irrigation construction will speed up the process of tapping existing potential—in China, as in many another LDC, surface irrigation facilities are chronically underutilized.[28]

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[25] *FBIS* Mar. 27, 1978, p. E18; Apr. 10, 1963; and Shantung-sheng Lai-yang nung-yeh hsueh-hsiao, *Hsiao-mai* (Peking, 1975), pp. 1–3.
[26] *FBIS*, Feb. 23, 1978, p. E17; Nov. 22, 1977, p. E6.
[27] *FBIS*, Jan. 31, 1978, p. E19.

In addition to the forms of mechanization implicit in the programs discussed above, the process of tractorization should be greatly speeded up, with as much emphasis on improved utilization of existing stock and production capacity as on new investment. Yields of foodgrains as a whole have been pulled down by the low yields of the second or third crops in multiple-cropping sequences, which is in turn due partly to delayed planting and poor management attributable to seasonal labor and draft animal shortages. By relaxing these bottlenencks, tractorization makes its most direct contribution to yields. However, the significant of tractors in transport, farmland construction, and in releasing the burden of draft animals on the feedstock should not be minimized.

As this incomplete summary should suggest, China's program for attaining its targeted growth rates is comprehensive and technically (and probably economically) sound; it responds simultaneously to the problem of accelerating the growth of the laggard regions and crops and that of enlarging potential at the technological frontiers. In its ambition and breadth of mobilization, it is comparable to the Great Leap, but, as with the more narrowly based programs of the last 15 years, the potential sources of growth have been correctly identified and are not illusory. The open question, then is not whether the program as stated is sufficient to meet the targets (even if we cannot quantify the potential contribution of each element of the program). Rather, it is whether China can mobilize and organize the resources to carry it out.

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[28] *FBIS*, Feb. 16, 1978, p. E13; Feb. 10, 1978, pp. E8–10

Part V. FOREIGN ECONOMIC RELATIONS

CHINA'S INTERNATIONAL TRADE AND FINANCE

By Richard E. Batsavage and John L. Davie

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I. Introduction

China's foreign trade, although a small component of gross national product, plays an important role in sustaining and modernizing the Chinese economy. A relatively small trade[1] sector, of course, is expected of a vast and populous country such as China, which has extensive domestic resources and a huge domestic market. Yet, the share of trade in China's GNP, only about 5 percent, is low by world standards reflecting the residual role assigned trade in the centrally planned economy and the conservative attitudes toward trade as a result of historical and more recent experiences.

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[1] In this paper, the term trade means foreign trade.

Trade is the balancing sector in the planning process with imports making up for shortfalls in domestic production and providing goods that cannot be produced in sufficient quantity, or at all, in China. Exports are not viewed as an end in themselves but as a means to pay for imports. Moreover, trade and financial policy has been very cautious, colored by Peking's view of the unhappy experiences with trade in both pre-1949 China and the period of Soviet cooperation in the 1950's. Self-reliance has been the guiding principle although its interpretation has been the subject of some debate in China over the years. Never officially defined, self-reliance has been described in such terms as "maintaining independence," "relying primarily on our own efforts," "keeping the initiative in our own hands," and "learning what is good from foreign countries." In practice, since the Sino-Soviet split, self-reliance has meant spreading imports among different suppliers, balancing trade over time, and making only sparing use of credits.

Despite its small share and conservative policy, trade has been quite important to the PRC. Imports aided the rebuilding of China's industrial base in the 1950's, have alleviated agricultural failures, and have provided industrial supplies and advanced technology to spur economic growth and modernization. In addition, trade has often provided a useful entree in China's relations with other countries.

China's trade since the 1950's has followed the changing fortunes of the economy, rising during periods of economic stability and suffering from the economic setbacks of the Great Leap Forward and the Cultural Revolution. This paper will focus on China's trade sector in the 1970's, a period of rapid trade growth, then setbacks, and policy debate. Trade trends in the 1970–76 period will be examined along with the economic and political influences on the trade sector. For the future, China's trade prospects will be discussed in light of the renewed emphasis on trade by the Hua regime and of China's economic capabilities and limitations.

II. Trade in Perspective—The First Two Decades [2]

A. The 1950's—Lean to One Side

Economic and political necessity led to heavy dependence on the U.S.S.R. The need to rebuild the economy amid the Western trade embargo imposed during the Korean War impelled Mao Tse-tung to pursue a policy of "leaning to one side," by which China based its industrial and technological growth on a rapid buildup of trade with the Communist countries. As a result of the close economic cooperation with the U.S.S.R. and Eastern Europe, trade between China and the Communist world shot from only $350 million in 1950 to almost $3 billion in 1959. (See Table A–1.) Trade with the West fell off after 1951 and accounted for only 25 percent of China's trade in 1955. (See fig. 1.) With the relaxation of Western trade restrictions in the second half of the decade, trade with the non-Communist countries rose. However, this trade still represented only about 30 percent of total PRC trade in 1959.

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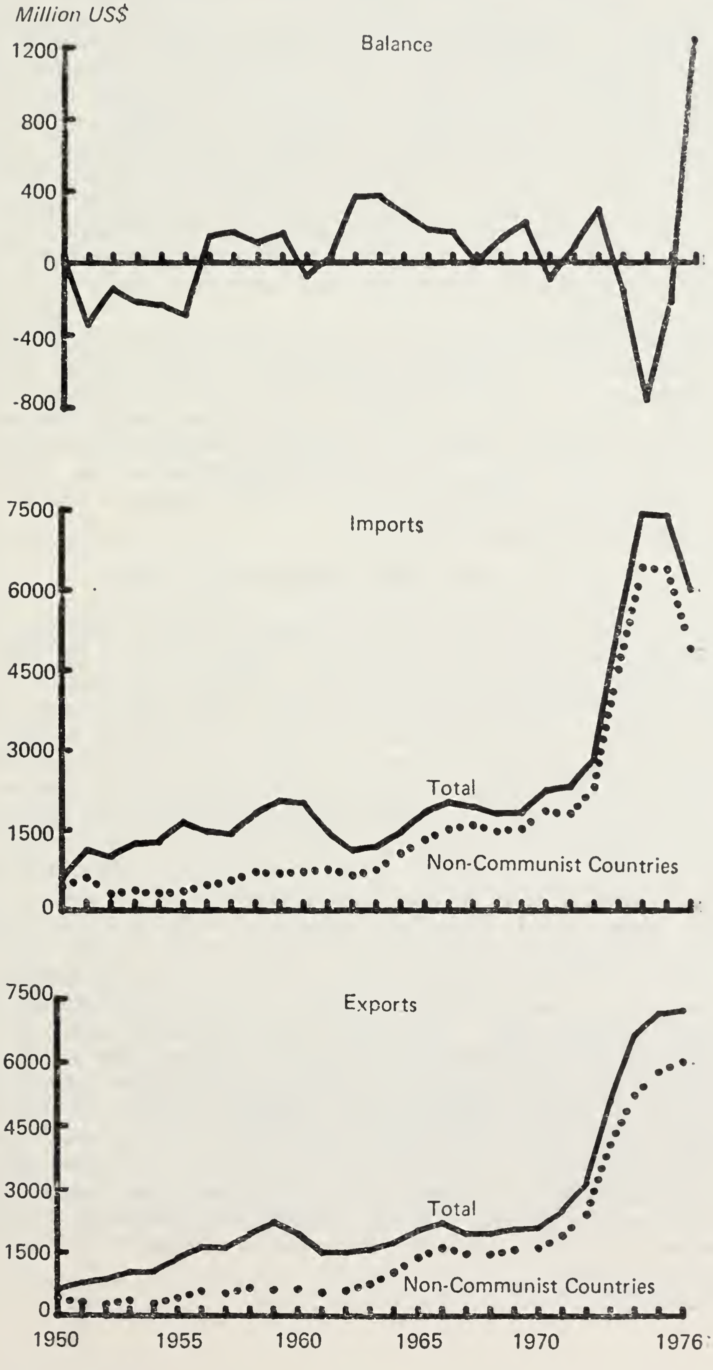
[2] For a more detailed treatment of this period see Robert L. Price, "International Trade of Communist China, 1950–65," in U.S. Joint Economic Committee, "An Economic Profile of Mainland China," Washington, D.C. U.S. Government Printing Office, 1967; and A. H. Usack and R. E. Batsavage; "The International Trade of the People's Republic of China," in U.S. Joint Economic Committee, "People's Republic of China: An Economic Assessment," Washington, D.C.: U.S. Government Printing Office, 1972.

FIGURE 1

China: Balance of Trade, 1950–76



Dependence on the Soviet Union in the 1950's produced one of the largest technology transfers in history. Trade with the U.S.S.R.—about one-half of China's trade over the decade—provided the major impetus to China's industrialization efforts, supplying both capital goods and industrial raw materials such as petroleum and metals. From 1950 to 1959, the Soviets delivered 1.35 billion dollars worth of equipment and completed about 130 projects, including factories for trucks, machine tools, and generating equipment. In addition, the Soviets provided massive technical aid in the form of blueprints and technical information, some 10,000 Soviet technicians and advisers,and training for 15,000 Chinese in the U.S.S.R. Soviet financial aid helped, although only $430 million of the $1.4 billion in Soviet loans was specifically for economic development. More important for Peking was the U.S.S.R.'s—and Eastern Europe's—willingness to accept large amounts of China's raw materials and consumer goods in payment for Chinese imports.

Despite the close cooperation over the period, tensions were building in the Sino-Soviet relationship. Disagreement over economic development strategy was an important factor in the growing dispute, particularly Mao's push to organize agricultural communes and his Great Leap Forward (1958–60). These two programs, in addition to the political strains they placed on Peking-Moscow ties, were also putting strains on China's agriculture and industry, which would affect trade in the years to come.

B. The 1960's—Reorientation to the West

The rift with the Soviet Union opened wider in midyear 1960 when Moscow withdrew its technicians, blueprints, and all. This was an added blow to the Chinese economy, already overstrained by poor agricultural performance and the excesses of the Great Leap. Many Soviet projects were abandoned or left in the planning stage and completed projects suffered from the lack of Soviet technical guidance. From 1960 to 1962 China's exports fell as industrial production declined, and imports were cut back sharply. Trade with the Communist countries plummeted from the $3 billion level of 1959 to only $1.1 billion in 1964. The U.S.S.R., and its ideological allies in Eastern Europe, Mongolia, and North Korea absorbed all the cuts as trade relations opened with Cuba and improved with Albania, Peking's partner in the split with Moscow. Trade levels would have been lower but for Peking's determination to repay its Soviet debts ahead of schedule by running a hefty surplus in trade with the U.S.S.R. from 1960 through 1965. Following a brief upturn in 1965–66, trade with the Communist countries fell below the billion dollar mark during the Cultural Revolution and accounted for only 20 percent of China's total trade in 1969. Offsetting the modest recovery in Sino-East European trade in the latter half of the decade was the steady decline in Sino-Soviet trade. Annual trade agreements were suspended in 1967 and relations hit bottom with the Sino-Soviet border clashes in 1969. Trade with the U.S.S.R., which had accounted for almost 55 percent of China's trade in 1959, was less than 2 percent of the total 10 years later.

The initial impetus to trade expansion with the non-Communist countries came from China's need for large-scale grain imports to offset harvest failures in the early 1960's. Grain imports from Canada, Australia, and other Western suppliers began in 1961 and have been a major import item since. In addition, China began to purchase large amounts of fertilizer from the West to support its agricultural sector. With the economy stabilizing in 1963 China turned to Japan and Western Europe for purchases of plant and technology. From 1963 to 1966 contracts were signed for more than 50 plants worth more than $200 million. A number of the plants were financed under medium-term credits and included the services of Western technicians. Trade with the West was set back by the disruptions of the Cultural Revolution, although not as severely as with the Communist world. Imports were trimmed back in 1967–68, in part to correct the trade imbalance resulting from lagging exports. Trade relations with many countries were strained by Red Guard harassment of foreign businessmen and technicians at plant sites and the plant import program was suspended. With calm returning in 1969, trade with the West recovered, but still not back to the level of 1966.

III. TRADE RESURGENCE IN THE 1970's

A. A Rapid Growth, 1970–73

With the restoration of order to the economy and the resumption of regular planning, Peking embarked on a program of increased emphasis on trade to spur economic development. The major facets of this program were the renewal of imports of capital equipment and technology, export expansion to pay for the increasing imports, and a return to the practice of financing major purchases through credits. At the same time rising industrial production in the 1970's created needs for larger imports of industrial supplies such as metals and rubber.

As part of China's diplomatic offensive, trade relations with the West improved as Peking opened diplomatic relations with the developed countries and many nations in the Third World, and joined the United Nations. The highlight of the period was the reopening of trade with the United States. Trade ties with the Communist countries picked up, too. Annual trade agreements with the U.S.S.R. were resumed in late 1970 and economic relations with Eastern Europe improved, particularly with Romania, reflecting Peking's support for Bucharest's independent stance toward Moscow.

China's trade soared from $4.3 billion in 1970 to $10.3 billion in 1973 with most of the growth coming in trade with the non-Communist countries. (See tables A–2 and A–3.) The trade series in current U.S. dollars is inflated by the effects of the devaluation of the dollar against other currencies in 1972 and by rising prices in the West. (See table A–4.) Nevertheless, the real growth was still substantial. In terms of 1970 dollars, trade with the non-Communist countries from 1970 to 1973 grew by almost 80 percent, compared with the 148-percent increase in current dollars. (See tables A–5 and A–6.)[3]

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[3] For a more complete discussion of this subject, see: Central Intelligence Agency, National Foreign Assessment Center, China: Real Trends in Trade with Non-Communist Countries Since 1970, Washington, D.C., October 1977.

The trade boom of the early 1970's began with a surge in imports in 1970, from heavy buying of metals and machinery. (See tables A–7 and A–8.) The resulting hard currency deficit led Peking to push exports, moving trade back into surplus in 1971. This was aided by generally lower import prices for many basic industrial commodities. Peking's technology import program began picking up steam in 1971. Contracts for substantial amounts of transport equipment and other machinery were signed and inquiries for complete plants became more numerous. Techimport, the trade corporation for plant and technology imports, was recreated in 1972. The first plant contracts were signed that year and in 1973 new plant purchases hit a high of $1.2 billion. (See table A–9.)

Several years of favorable harvest had permitted China to cut back its grain purchases to only 3 million tons in 1971. By 1972 poor agricultural performance pushed grain needs back up to 4.8 million tons and then to a record 7.7 million tons in 1973. In addition to grain, China was also forced to import large amounts of soybeans, edible oil, and cotton to supplement domestic production. Unfortunately for Peking, world markets for agricultural products were very tight and prices were rising rapidly. Agricultural imports on top of sharply higher deliveries of steel, nonferrous metals, and machinery raised the value of total imports by 83 percent over 1972. Peking's export drive was also taking shape and exports rose by 61 percent that year. Markets were expanded and China took advantage of rising demand for its goods in the West to boost its prices to international levels. At the same time the Arab oil embargo created a fresh market for China's newly available supplies of petroleum. Although China's hard currency trade with the West shifted in 1973 from surplus to a $440 million deficit, use of short-term credits for grain purchases eased the financial strain on the balance of payments.

The rapid growth in trade with the non-Communist countries over the 1970–73 period was spread over both the developed countries and the Third World. Imports from the developed countries were fueled by purchases of steel, machinery, and equipment from Japan and Western Europe and by increased grain purchases from Canada and Australia. The United States was a unique case, moving from no trade to China's third leading trading partner in 1973 as a result of massive agricultural purchases beginning in late 1972. Due to tight world supplies Peking was forced to turn to the United States when traditional suppliers were unable to meet its needs for grain, cotton, and other agricultural commodities. Trade with the Third World prospered as new and expanded trade ties with these countries boosted Chinese exports and China began purchasing more raw materials such as rubber and nonferrous metals directly from producer countries. Trade with the Communist world roughly doubled over the period, but its share of China's total trade slipped from 20 percent to 17 percent. Major gains were scored in China's trade with the U.S.S.R. (which increased more than five times from its all time low of $47 million in 1970), with Romania, and with North Vietnam to support its war effort.

B. Retrenchment, 1974–76

China's trade strategy unraveled in 1974. Rampant inflation in the West and heavy deliveries of machinery and agricultural products pushed import costs to a peak while the slowdown in the Western economies cut demand for Chinese exports. Although another substantial trade deficit was expected, Peking probably did not anticipate the record $1.2 billion imbalance in its trade with the non-Communist countries in 1974. The crunch came in the second half of the year as rising repayments on grain credits from the previous year and lagging exports put strains on the balance of payments. Peking reacted swiftly to reduce foreign exchange outlays by canceling and postponing deliveries on contracts for agricultural products and by trimming purchases of plants and major equipment to reduce downpayment expenses.

Record agricultural imports and sharply higher machinery and equipment deliveries accounted for most of the 42 percent rise in imports in 1974. Agricultural imports alone totaled about $2 billion. Of the 10 million tons of grain originally under contract only 7 million tons were delivered. Although 700,000 tons less than the 1973 deliveries, higher prices and freight rates pushed the value up about 40 percent to $1.2 billion. The value of both sugar and soybean imports rose sharply, and even cotton imports were higher despite the cancellation of contracts for US cotton in the second half of 1974. Imports of machinery and equipment in 1974 hit $1.6 billion, more than double the 1973 total, as large scale deliveries began on the more than $3 billion in contracts signed in the previous 2 years for complete plants, transport equipment, and construction and mining machinery.

Although PRC exports in 1974 grew by a respectable 30 percent over 1973 this was only half the rate achieved in the previous year. Much of this increase was achieved through larger sales of petroleum at the substantially higher OPEC prices (about 4 million tons worth $425 million, compared with about 1 million tons worth $30 million the previous year). After boosting prices for their nonoil goods to world levels, the Chinese found many of these goods were now overpriced in the slack Western markets.

In 1975 China made substantial progress in correcting its trade imbalance. The important hard currency deficit with the non-Communist world fell by one-half to $585 million. Sharply lower agricultural imports enabled Peking to reduce total imports marginally while exports, after a slow start, rose by 8 percent. Oil saved the day for Chinese exports as sales of crude oil and petroleum products jumped to $910 million. Crude oil deliveries to Japan, the principal market, doubled to about 8 millions tons worth more than $700 million. Non-oil exports declined slightly, even though Peking was able to regain some lost ground particularly in textiles through price cuts and some recovery of demand in the West.

China slashed its import bill for agricultural products by $1 billion in 1975. An improved grain harvest in 1974 permitted the PRC to cut imports of wheat and corn to 3.3 million tons, less than half the amount taken the year before. Sugar and cotton imports were also reduced and soybean purchases were nearly eliminated. Offsetting the fall in agricultural imports was a sharp rise in metals and machinery deliveries. Steel purchases increased by 28 percent in value over 1974 and the volume of aluminum purchases was five times the level of the previous year as Peking stockpiled at low world prices. With deliveries on whole plant contracts in full swing, machinery and equipment imports jumped to $2.2 billion. The lull in new plant contracts that began in the fall of 1974 continued through most of the year. Plant purchases totaled $364 million for the year, less than one-half the 1973 total.

Peking may have planned to continue its efforts to correct its trade imbalance in 1976. Political turmoil between the deaths of Chou En-lai and Mao Tse-tung disrupted the economy and reinforced this trend, resulting in a record $1.2 billion surplus as imports plunged while exports held steady. Leftist criticism of trade policy had surfaced back in 1974 but the impact on trade flows is questionable. Policy debates over trade flared anew as part of the leadership struggle following the death of Chou and the ouster of Teng Hsiao-ping. Although the trade ministry remained largely under the control of the moderate faction, lack of agreement on the new five year plan, disruption in the domestic economy, and leftist criticism of trade inhibited initiatives by the trade corporations. The severe Tangshan earthquakes in July had little apparent effect on trade. Evacuation of foreign businessmen from Peking postponed some negotiations and some export deliveries were delayed. Fourth quarter exports, however, probably reached the highest level ever.

A combination of lower volumes and lower prices cut China's import bill by almost $1.4 billion in 1976. Good harvests in 1975 and some drawing down of stocks permitted the Chinese to cut grain purchases to only 2.0 million tons worth $325 million. Soybean and cotton imports were down, and low world sugar prices held down costs despite a doubling of import volume. Whole plant equipment began to level off as contract deliveries were completed, and transport equipment imports fell as truck and ship purchases were sharply curtailed. Whole plant contracts fell to only $185 million.

As for exports, crude oil earnings fell by almost $100 million as sales to Japan dropped off. Although the leftists were criticizing exports of oil, this decline stemmed largely from the refusal of Japanese refiners to buy more. Continued economic recovery in the West plus further price cuts enabled China to boost sales of light manufactures and other consumer goods enough to keep total exports at the 1975 level.

Trade patterns in the 1974–76 period remained fairly stable, although shifts in some commodities particularly on the import side have varied the shares of several trading partners. Figures 2 and 3 show the geographic distribution of China's imports and exports over the 3-year period. The non-Communist countries continued to dominate both imports and exports. Almost three-quarters of China's imports came from the developed West. Japan was far and away the leading supplier with Western Europe, led by West Germany and France, accounting for another large share. The U.S. share was, of course, influenced by the large agricultural shipments in 1974. Despite the rapid phaseout of these commodities, the United States remained in the top 10 in 1975–76 on the strength of its sales of machinery and industrial supplies to China. China's exports have been more evenly distributed. Japan, due in good measure to oil sales, and Hong Kong provided China's two major markets, accounting for over one-third of China's total sales. The remainder, however, was widely dispersed among the developed countries, the Third World, and the Communist countries with no one country having more than a 5-percent share.

FIGURE 2

China: Distribution of Imports, 1974–76

Percent

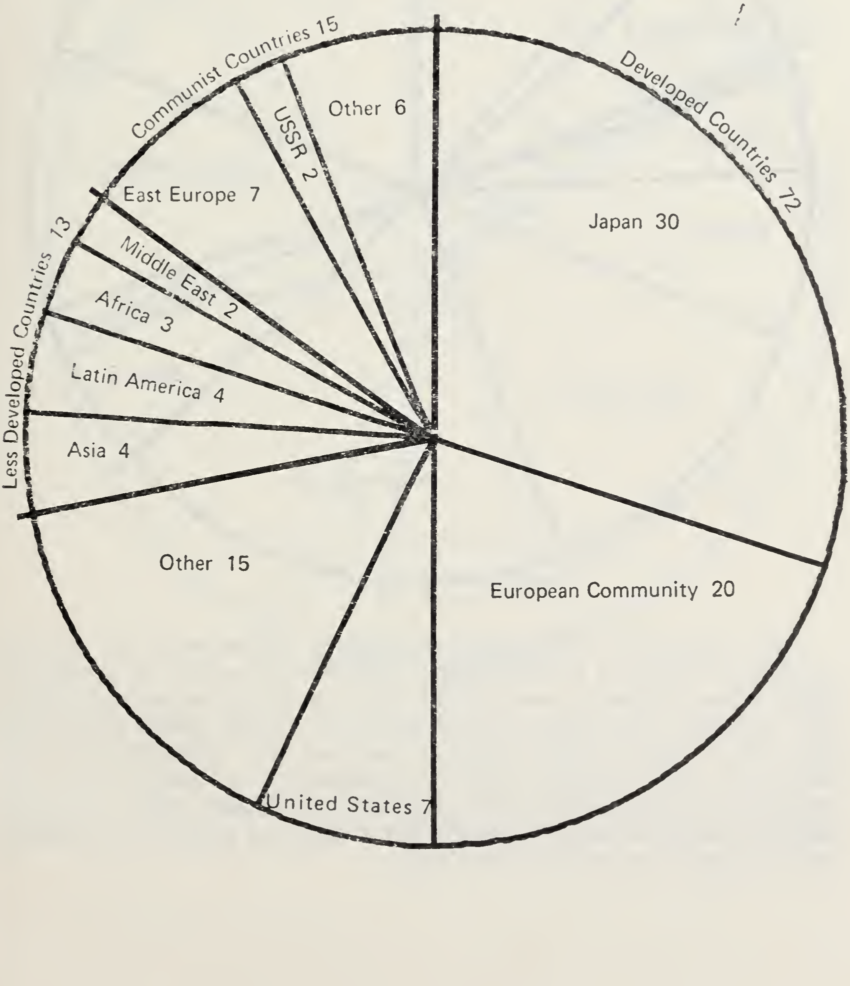
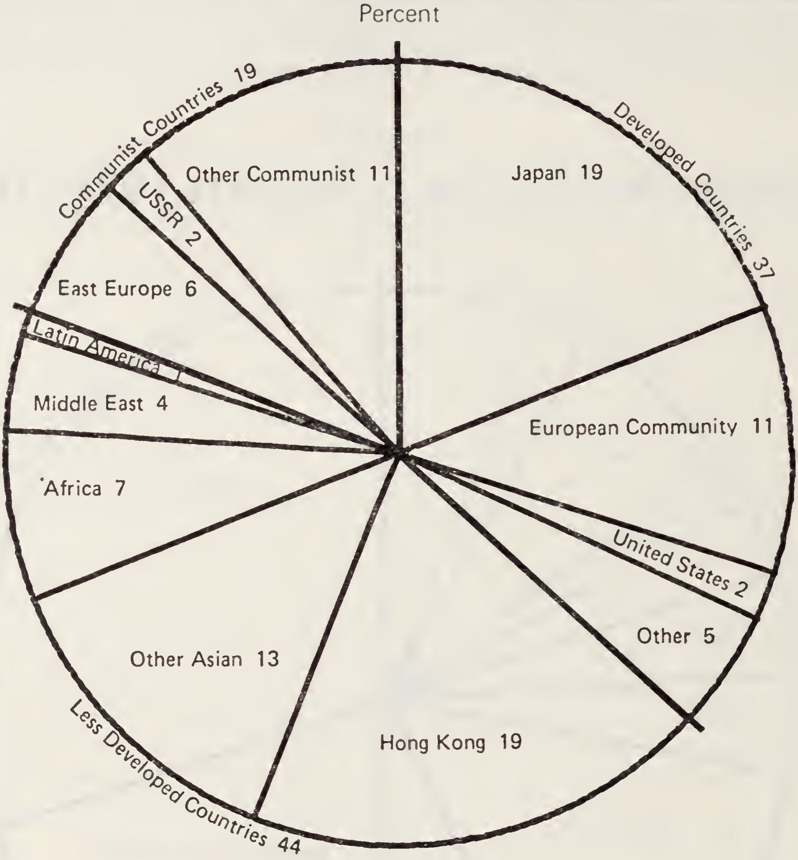


FIGURE 3

China: Distribution of Exports, 1974–76



The commodity distribution of imports and exports for 1974–76 as shown in figures 4 and 5 show patterns similar to the geographic distribution. Imports were heavily concentrated in metals, machinery, and transport equipment. Foodstuffs and textile fibers would have garnered a larger share were it not for the cutbacks in these items after 1974. Although China's economy is still heavily agrarian, exports of manufactures now account for almost half of Chinese exports. Crude oil exports, despite the widespread publicity, accounted for less than 10 percent of total sales.

FIGURE 4

China: Composition of Imports by End Use, 1974–76

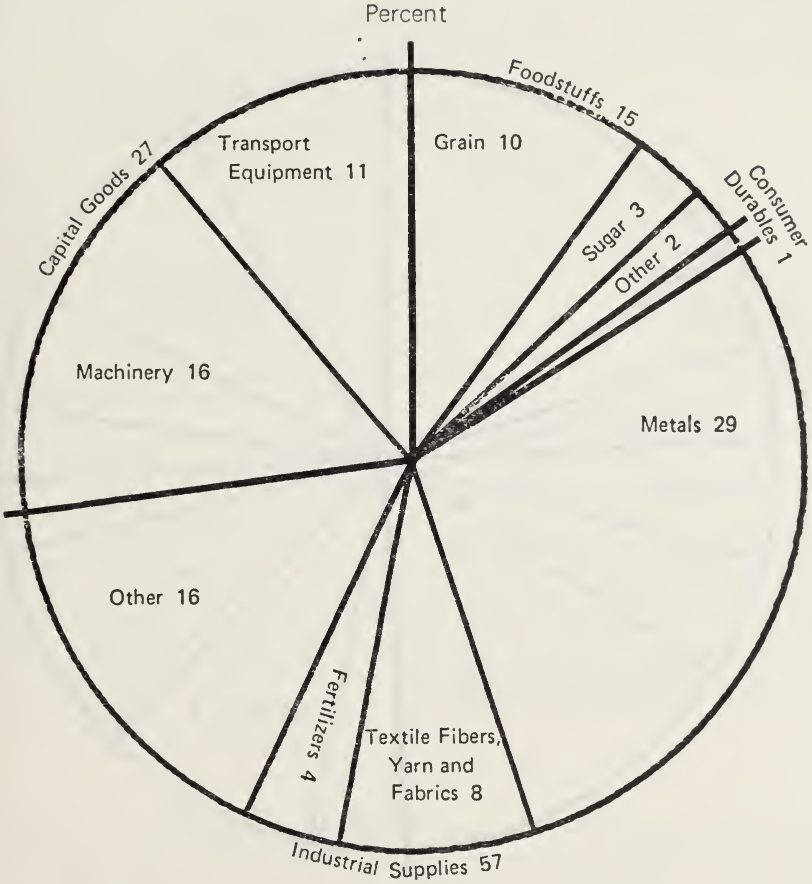
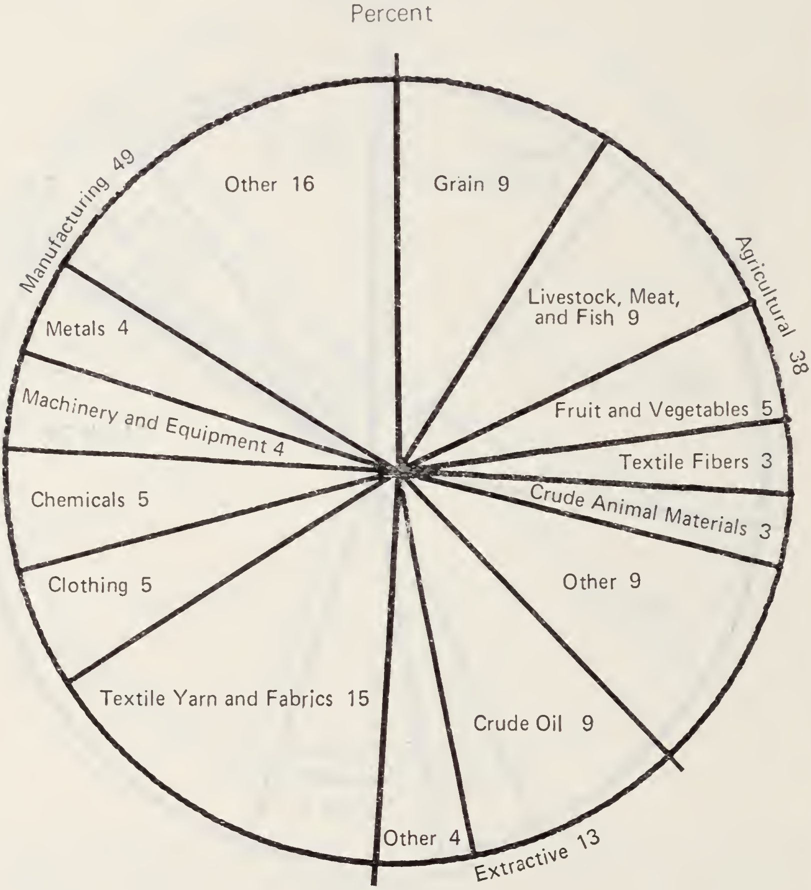


FIGURE 5

China: Composition of Exports by Sector of Origin, 1974–76



C. A Year of Rebuilding, 1977

Following the ouster of the "gang of four" in October 1976, the Hua Kuo-feng regime openly reaffirmed the active trade policies of the 1970's and emphasized the importance of foreign technology. This commitment to expanding trade was echoed at the national foreign trade conference held in Peking in July 1977 and in a number of other industrial conferences held during the year. Foreign businessmen were cautioned, however, not to expect an immediate surge in orders for plant and equipment because 1977 would be a year of rebuilding for the economy after the setback of 1976.

Although trading partner data for 1977 are incomplete, NCNA announced in January 1978 that exports and imports in 1977 grew by more than 12 percent over 1976, reaching the highest total in the history of the People's Republic of China with a favorable balance-of-foreign exchange.[4] Using the CIA's estimate of trade for 1976, this would put total trade for the year at about $14.8 billion. Imports probably grew faster than exports, shrinking China's surplus to an estimated $1 billion. Partial trade returns from about 25 of China's major trading partners support the Chinese claim. Data from these countries suggest an increase of about 10 percent in China's exports and roughly 15 percent for imports.

Agricultural imports—at least 1.5 billion dollars worth—and industrial supplies, principally steel and nonferrous metals, led the growth in imports. Lagging agricultural performance forced Peking to resume large scale grain imports, 6.8 million tons. Imports of cotton, sugar, soybeans, and soybean oil also increased. Unlike in 1973–74, however, China benefited from low world agricultural prices. Imports of whole plant equipment dropped off as most deliveries under 1973–75 contracts were completed. Large purchases of used ships in anticipation of increased trade boosted transport equipment imports. Non-oil goods accounted for most of the growth in exports; petroleum deliveries probably posted only moderate gains over 1976.

Delays in setting import priorities held down new contracts for complete plants—only three contracts worth about $60 million were signed. Orders for major equipment did pick up steam, however, reaching perhaps $200 million.

Japan regained lost ground as increased Chinese oil sales and steel purchases boosted trade. Trade rose with Australia and Canada, the principal grain suppliers, and with Hong Kong, the major export market. Sino-United States trade increased slightly after 2 years of decline with the resumption of cotton and soybean deliveries late in the year. Third World trade also grew due to increased agricultural purchases. Trade with Western Europe, however, fell again reflecting the windup of complete plant deliveries.

D. International Finance in the 1970's

China's international financial activity picked up along with its trade in the 1970's. Short-term credits for grain purchases, which had been used regularly since 1961, increased sharply with the rising grain imports. Medium-term (up to 5 years) supplier credits for complete plant purchases were resumed on a much larger scale than in the mid-1960's. By use of these credits China was able to accelerate the pace of its capital imports faster than export growth would allow and to smooth out the payments on its grain imports.

While China's use of credits expanded sharply, Peking's credit policy remained quite conservative and debt was kept within safe limits. Of the $2.7 billion in plants purchased only about $1.5 billion were financed under credits; the rest were on a progress payment basis. Table A–10 details China's use of credits since 1970. The level of outstanding debt has been less than $2 billion and the highest debt service to export ratio since 1970 was 17 percent in 1976, a year of record trade surplus.

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[4] BBC, SWB, FE/W965, Feb. 1, 1978, p. A-19.

While sufficient data is not available to construct a meaningful balance of payments for China, a rough picture of its international finances can be formed from trade data and estimates of current account and credit items. Table A–11 shows the approximate financial gap or surplus facing the Chinese each year since 1970. The financial gap was sizable only in 1974—$575 million—and probably required the Chinese to dip into reserves. With the sharp improvement in the trade balance in the next 2 years, the gap shifted to surplus and Peking was able to rebuild its reserves.

Information on China's holdings of gold and foreign exchange is very limited. Since June 1974, however, the Bank for International Settlements (BIS) has published data on the foreign exchange liabilities and assets of its member banks vis-a-vis China.[5] Although the coverage is not complete, the liabilities to China reflect the level and trends of China's foreign exchange holdings and the assets probably reflect the amount of foreign currency deposited, in effect on loan, with the Bank of China. The BIS data shows liabilities to the Bank of China growing from $417 million at the end of 1974, to $1 billion at the end of 1975, then to $1.4 billion by yearend 1976. These liabilities stood at $2.4 billion by the end of September 1977. Assets of these banks vis-a-vis China on the other hand have fallen from a high of $883 million in December 1975 to $247 million in September 1977, indicating reduced Chinese needs for this short-term deposit borrowing.

Much less is known about China's gold reserves. Following the purchase and importation of 213 tons of gold in the late 1960's, the only firm information on Chinese gold activity has been the shipment of 80 tons of gold in late 1976 from Peking to London. Little is known about China's domestic gold production. Judging from the BIS data, China's total foreign reserves may be around $4 billion, an adequate amount in view of Peking's conservative financial policies and tight control over its foreign trade.

IV. CHINA'S FOREIGN TRADE POLICIES

Since China's foreign trade is a state monopoly, the level, commodity composition, and direction of trade reflect the policies of the central leadership to a much greater degree than in market economies, where decisionmaking is dispersed among many autonomous individuals. Under these circumstances political considerations are bound to have a larger impact on trade.

Peking generally has viewed trade as an instrument to foster its overall goal of making China a strong, self-reliant nation. Differences appear to have arisen among China's leaders, however, over how much, what, and with whom China should trade to achieve these ends.

Actually, controversy over the issue of how much contact China should have with the West precedes the Communist ascension to power. It has historical antecedents dating back nearly two centuries to China's first encounters with American and European traders. Until the opium war (1839–42) foreigners were excluded from direct business dealings with the Chinese, and relations were conducted on Chinese terms. With the establishment of treaty ports, however, customs collections fell under the control of foreign powers, and China was "opened" to world commerce. Although several Chinese scholars advocated reform of the Confucian system and acceptance of Western ways—meaning not only Western religious and political thinking, but also Western technology and business practices—China's leaders were impotent and their pleas fell upon deaf ears in Peking. Outbursts of xenophobic passions, such as during the Boxer Rebellion (1900), merely resulted in a further carving up of China by foreign powers. After the First World War, many of the Chinese who went abroad to study brought back an interest in increasing commercial and scholarly exchange with the West. Their potential impact on the Chinese economic and political system, however, was cut short by World War II and the Communist victory.

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[5] "Eurocurrency and Other International Banking Developments," quarterly reports, Monetary and Economic Department, Bank for International Settlements, Basle, table 7.

A. Ideologists Versus Pragmatists

Since the Communist takeover, two groups advocating different policies evolved: one, which takes a highly ideological stand and looks at economic relations with "capitalist" countries in terms of traditional Marxist theology; and the other, which takes a more pragmatic attitude, and which, while mindful of China's past, appears more willing to deal with "capitalists" for China's economic advantage. In recent years China watchers have labeled individuals belonging to each group "radicals" and "moderates," respectively. The "moderates" view China as a weak, vulnerable, underdeveloped country which must be transformed as rapidly as possible into a modern industrial state. They believe, among other things, that modernization requires scientific exchanges with and imports of technologically advanced investment goods from the West. On the other hand, the "radicals" believe that large-scale imports of foreign goods undermines faith of the people in the success of the revolution and makes China vulnerable to economic "blackmail." The radicals believe that reliance on foreigners rekindles the sense of inferiority caused by a century of humiliation at the hands of the West and that exposure to capitalists, capitalist-made products, and capitalist business procedures erodes the "revolutionary will" of the masses, leading to "revisionism." According to this viewpoint, China should rely primarily on the "wisdom of the masses" in order to develop and master new technology and limit reliance on the outside world.

B. The Recent Trade Debates

The most recent airing of these issues occurred during the campaign to criticize Lin Piao and Confucius (1973–74) and the anti-Teng Hsiao-ping campaign (late 1975–76). In the former, allegorical articles appeared in the Chinese media attacking and defending the foreign trade policies that were then being implemented by the moderates, led by Premier Chou En-lai. The radicals charged that the moderates were "slaves of foreigners," "not relying on the masses," and "being agents of imperialism." In rebuttal, China's Minister of Foreign Trade Li Chiang, writing in the magazine China's Foreign Trade,[6] acknowledged the need for China to pursue a policy of self-reliance and reaffirmed that China did not intend to attract foreign investment capital, condone exploitation of domestic natural resources, or engage in joint ventures. He did state, however, that China wished to participate in business negotiations "in light of common international trade practices." Li defended a policy of "making foreign things serve China," by quoting a speech made by Mao Tse-tung in 1949, which declared "the Chinese people wish to resume and expand international trade in order to develop production and promote economic prosperity."

Later (in 1975) this line was advanced in an article entitled "Some Questions on Accelerating the Development of Industry," authored by Vice Premier Teng Hsiao-ping. Teng proposed increasing exports of China's natural resources to pay for imports of technology and use of "accepted practices of international trade such as deferred payments and installment payments." After Teng's fall in April 1976 the "gang of four" criticized Teng as a traitor who wanted to "sell China out to the imperialists," shift "the international energy crisis onto the Chinese people" and turn China into a "raw material base," a "repair assembly workshop," and an "investment ground for imperialism."

C. Formulation of Trade Policies

In order to shed light on the future course of China's trade, it would help to know what policy differences actually separated the radicals from the moderates and what role each faction played in formulating China's trade policies during the 1970's. If, on the one hand, the moderates were largely responsible for shaping China's trade policies and the radicals had little impact on decisionmaking, then we might expect the essentially conservative policies that were pursued from 1974–76 to continue into the future. If, on the other hand, the moderates had intended to implement more expansionist trade policies but were held in check by the radicals, then we might expect more expansionist trade policies to follow, now that the radical opposition has been removed.

Both interpretations generally agree on one point: that the trade policies China followed in the 1970's were, by world standards, extremely conservative. Exports financed imports, and the Chinese made only sparing use of supplier credits. Imports were largely stopgap measures, designed to fill voids in either domestic production or capacity. Grain imports, for example, amounted to less than 2 percent of domestic production. China pursued a policy of import substitution, purchasing plants that would produce domestically commodities currently imported from abroad—steel, petrochemicals, synthetic textile fibers, fertilizers, and, indirectly, wheat. Thus, imports of capital equipment were aimed more at reducing reliance on foreign economies than at improving China's competition position in exporting to the world's market.

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[6] *China's Foreign Trade*, vol. I, 1974, Peking, pp. 2–5.

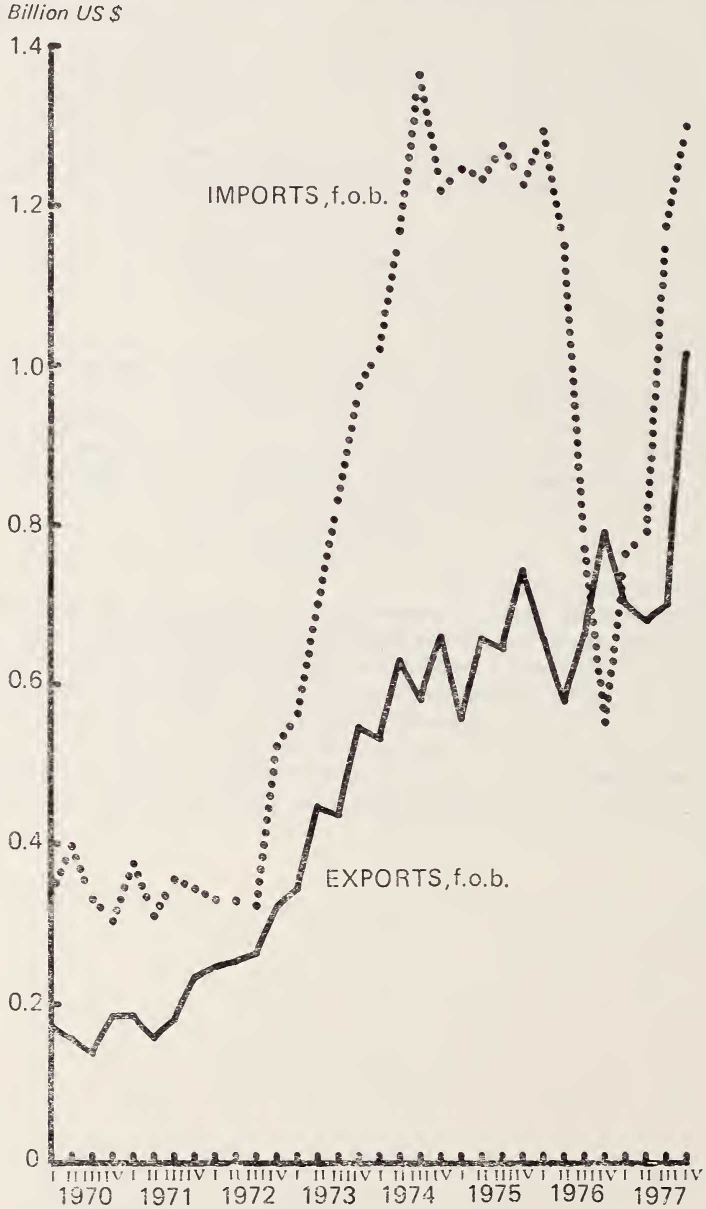
Two scenarios emerge on the causal factors behind these trade policies. According to one scenario, the moderates, led by Chou En-lai and Teng Hsiao-ping, were in complete control of foreign trade organizations and policies throughout the 1970's. The policies of both Chou and Teng were motivated more by economic than by political factors. Thus, the large size of China's domestic markets and low per capita income explain the low levels of China's trade. If the radicals even had a foreign trade policy, the differences between the moderates and the radicals were narrow. They differed not on principle, but on the degree to which China could increase trade and still remain self-reliant. There were virtually no differences between the radicals and the moderates with regard to foreign participation in the Chinese economy; that is, the use of joint ventures, product repayment schemes, government-to-government loans, and direct foreign investments were ruled out by both factions. Thus the radical attacks on the moderates' foreign trade policies were inflated, disingenuous and motivated largely by political opportunism.

According to this theory, Chou En-lai and the moderates in the State Council were responsible for the cutback on imports which began in 1974. This was a reaction to a worsening trade deficit, declining terms of trade, and an improved harvest, which permitted grain imports to be reduced. Although the Campaign to Criticize Lin Piao and Confucius coincided with these cutbacks, the net effect of this criticism was not great. The decline in contracts for whole plants after 1973 was the result, not only of balance of payments factors, but also of a need for a breathing space to absorb the large amounts of technology already purchased.

Advocates of this theory concede that the sharp decline in imports from developed countries following Teng's purge (see figure 6) was partially the result of activities by the "gang of four," but they would argue that the impact on trade was felt only indirectly through disruptions of the domestic economy, not through a change in trade policy. They point out that exports continued to expand in 1976, reaching the highest level ever in the fourth quarter. If there had been a change in policy, it probably would have affected exports as well as imports.

FIGURE 6

China:
Trade With the Developed Countries[1]



[1] *Data are from International Monetary Fund, Direction of Trade Tapes and from OECD, Statistics of Foreign Trade, Monthly Bulletin.*

Furthermore, according to this theory, economic constraints will continue to hamper expansion of China's trade. If China's trade does expand significantly, it will be primarily because China's domestic economic situation has stabilized and its balance of payments has turned favorable in the past 2 years.

An alternative scenario would stress the effect of political factors on China's foreign trade. Thus the low levels of trade are explained largely by a Chinese aversion to economic dependence on the outside world, resulting from a long history of exploitation by the colonial powers, and most recently by the Soviets. The radicals and moderates may not have differed substantially over China's financial policies; however, they disagreed sharply over trade policies. In particular, the policy of exporting oil and other raw materials to pay for imports of high technology goods from the West was anathema to the radicals.

While the radicals may not have been ensconced in the State Council and the bureaucracy, they nevertheless wielded significant influence over policymakers through their control of the press and their positions in the party. The radicals tempered what would have been an expansionist trade policy, which Chou and Teng wanted to institute. Fear of attacks by the radicals prevented the moderates from openly espousing such policies. Thus, statements by moderates that China must remain self-reliant and that China did not condone exploitation of its natural resources, were merely rhetoric—concessions the moderates were forced to make to the radicals.

According to this theory, there is a high correlation between the waxing and waning influence of the radicals and the contraction and expansion of China's trade. Commercial activity fell off at the height of the Cultural Revolution, expanded rapidly with the increasing influence of the moderates, began to contract during the anti-Lin anti-Confucius campaign, increased briefly during Teng's short reign at the end of 1975, then nearly collapsed following his purge. Since the ouster of the "gang of four," imports have again picked up, following the new leadership's call for a return to the active trade policies followed by Chou En-lai.

According to this theory, the radicals did not need to "take over" the Ministry of Foreign Trade in order to influence trade policy—their influence was more pervasive. Bureaucrats responsible for carrying out day-to-day trade operations, not wanting to be on the wrong side of the fence, became intransigent during periods of heated debate. Chinese exporters demanded prices that were prohibitively high so that they could not be blamed for giving away their products. Import negotiations, likewise, slowed or came to a standstill because of inflexibility on the part of Chinese negotiators.

The logical conclusion to this scenario is that now, with the demise of the "gang of four," the moderates are free to pursue more expansionist trade policies and China's trade is likely to take a new leap forward within the not-too-distant future.

D. The Impact of Economics and Politics on Trade

The interplay of global and domestic economic factors and of Chinese politics is complex, and the relative impact of each of these on China's trade policies and operations cannot be weighed with much precision. If economic factors were sufficient to explain not only the absolute level but also changes in the level of China's foreign trade, the first scenario would be closest to the truth and the second could be largely discarded. And, vice versa. Since China's political struggle undoubtedly has had some restraining effect on trade, determining which scenario is closest to the truth hinges in large part on knowing the motives and intents of the individuals involved. Assessments of this nature are always tenuous, and doubly so in China's case. The sources of information for making judgments on the motives and the positions of China's leaders are largely limited to the articles that appear in the Chinese press. Those in power control the press, and any Chinese account of the period—either those appearing now or at the height of the radicals' attack—is bound to be biased. Undoubtedly the differences between the radicals and the moderates were magnified in the propaganda as the radicals sought to discredit their moderate opponents, and vice versa. The sensitivities of the Chinese populace made the trade issue an easy target for the radicals to exploit. On the other hand, the long history of debate about China's relationship to the rest of the world suggests that the recent debates were not mere polemics but also reflected genuine differences over trade policies. Moreover, the debates are not likely to end simply because the "gang of four" has been ousted.

Thus, we are left with the untidy conclusion that both scenarios are needed to explain all that has taken place in China's foreign trade. The political struggle probably tempered general trade policy through most of the 1970's and held down trade initiatives and other trading operations at least in 1976. Yet, many changes in trends of major commodity imports correlate well with domestic and international economic forces, strongly suggesting influences having little to do with Chinese domestic politics.

V. POST-MAO TRADE: PROSPECTS FOR FUTURE GROWTH

The pro-trade rhetoric emanating from Peking and the ambitious economic goals announced at the recent National People's Congress point to some sizable increases in trade over the next 8 years. Imports of foreign technology will be the major feature in China's purchasing plans, industrial supplies will rise as production picks up, and agricultural imports will continue at varying levels. Export growth will be the key determinant of import expansion although the use of credits, perhaps under somewhat more liberal financial policies, will permit higher initial rates of trade growth.

Overall, trade may grow at perhaps 10 to 20 percent per year. Self-reliance is still the stated policy, albeit with a more pragmatic interpretation. Peking is cognizant of the lessons of the past and will continue to react to trade imbalances and balance of payments problems.

Trade expansion, of course, will mean greater exposure of China's trade sector to domestic and international forces. Prices, commodity shortages, and exchange rate fluctuations will influence trade patterns. Also, as in the past, domestic economic setbacks and political turmoil may alter the course of China's trade in the future.

A. Export Potential

China's export mix comprises a broad range of foodstuffs, raw materials, textiles, and light manufacturers. These goods face the twin problems of either inadequate supply for marketable products such as nonferrous metals, or limited demand for such items as crude animal materials. Through 1985 China could reasonably boost its exports at least 10 percent a year. Peking's current strategy appears to aim at rapid short-term growth in exports of crude oil and coal with a gradually accelerating growth in exports of manufactures.

1. ENERGY EXPORTS

While increased sales of energy resources, particularly oil, have been touted by Peking, the long-term potential for such exports is uncertain. Projections suggest that rising domestic demand together with a levelling off in the growth of output will cause a decline in the amount of oil available for export by the mid-1980's.[7] China's reserves are plentiful, but again, rising domestic demand and the need for investment in this sector will hinder export growth. For the near term, exportable surpluses of oil exist, yet marketability is hampered by high prices, high transport costs, and undesirable refining characteristics.

Japan, at present, is the only viable major market. The long-term agreement (1978–85) signed with Japan in February 1978, will secure a market for China's oil and coal. Deliveries for the first 5 years will total 47 million tons of oil and 9.2 million tons of coal. Quantities will rise gradually to 1982 goals of 15 million tons of oil and 6.8 million tons for coal. Increased quantities for the last 3 years of the agreement will not be negotiated until 1981. Oil and coal exports over the life of the agreement are to total $10 billion. Although the agreement is helpful to the Chinese for planning purposes, problems still exist on the Japanese side. The 15 million-ton goal is about 4 million tons more than the Japanese refiners presently desire and will require the construction of costly cracking facilities in Japan. Thus, the prospects for major increases after 1982 appear doubtful.

2. TRADITIONAL EXPORTS

China will continue to export sizable amounts of agricultural products, but the share of the agricultural sector in China's total exports will likely decline from its present 37 percent. Even if China is able to attain the ambitious targets set for agricultural output in the current plan, population increases and demands for improved living standards will hold down growth of foodstuff exports.

Manufactured goods seem to offer the most favorable area in which to boost exports by moving into higher value-added items. China has had good success in increasing sales from its manufacturing sector and has stated its intention to raise the share of manufactures in total exports. Chinese trade delegations are roving the world seeking better knowledge of foreign markets; trading corporations are making greater efforts to produce goods to buyer specifications and to insure prompt delivery; and two new trade corporations—China National Packaging Corp. and China National Arts & Crafts Import-Export Corp.—have been set up. Also, officials have talked of setting up industrial plants to specialize in export products. Given its abundant supply of low-wage labor, China should be able to make further gains in exports of light manufactures at the lower end of the technology scale.

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[7] Central Intelligence Agency, Office of Economic Research "China: Energy Balance Projections, 1980 and 1985," in Congressional Research Service Library of Congress, "Project Interdependence: U.S. and World Energy Outlook Through 1990," Washington, D.C., U.S. Government Printing Office, November 1977, pp. 858–881.

Large export growth will not come overnight. In the short run, progress will still be hampered by inadequate supply, because many of the raw materials come from China's slow-growing agricultural sector. Learning foreign markets and upgrading the quality of export goods will be a slow process. Expanding exports of manufactures to the West, particularly the developed countries, will also expose China to the uncertainties of shifting tastes. Moreover, export growth will create some problems of its own. Higher levels of many traditional exports will run into barriers from protectionist actions, especially for sensitive products such as textiles and footwear, and from growth of competing industries in the Third World. Japan, Australia, and Canada have already restricted imports of Chinese silk, textiles and footwear, and the European Community insisted on a safeguard clause in the recent trade agreement with China to prevent market disruption.

B. Import Prospects

While exports will be the determining factor, imports will be the *raison d'etre* for China's trade expansion in the future. Purchases of foreign plant and equipment will be a major component of China's economic modernization drive, industrial supplies will help sustain growth in industrial production, and agricultural imports will compensate for shortfalls in the farm sector. Because imports will be tailored largely to export growth, they will likely grow at roughly the same rate over the 8-year period. The use of import financing (to be discussed in the next section) will permit more rapid import growth in the beginning.

1. TECHNOLOGY PURCHASES

Imports of foreign technology lay at the heart of the periodic debates over self-reliance. With Teng Hsiao-ping the driving force, the current leadership is stressing a pragmatic line on learning from foreign countries and acquiring advanced technology. Import priorities may not be firmed up yet and there could still be some disagreement within the leadership over the proper level of such purchases. A new round of contract signings is not yet underway, but judging from the number of inquiries and negotiations and the size of the facilities under consideration the level of purchases will far outstrip that of the 1970–75 period. One major indicator is the Sino-Japanese long term agreement which commits Peking to purchase $10 billion in Japanese equipment including about $8 billion in complete plants. If Japan were to increase its share of PRC plant purchases to one-half, compared with about a third in the 1970–75 period, total plant contracts during 1978–85 would be more than five times the level of 1970–75. Besides plants, Chinese purchases of other major machinery and transport equipment could push total technology purchases to the $30 billion range over the next 8 years.

Technology purchases, particularly plants, will have a lagged effect on trade levels. Even if heavy contract signings began this year, deliveries would not get underway until late 1979 at the earliest.

Technology purchases will be aimed at modernizing lagging sectors of the economy, particularly basic sectors such as metallurgy, electric power, transport, petrochemicals, electronics, mining, and petroleum. From the impressive shopping list emerging from Peking it is clear that, once again, the Chinese goal is to buy capacity as well as to acquire advanced technology. When on line these facilities will boost domestic production and yield import substitution benefits. Special interest has centered on steel plants to aid in achieving the recently announced target of 60 million tons of steel by 1985. Negotiations are underway for a 6-million-ton capacity steel mill to be built in Shanghai and for the modernization of two other mills in China. Other plants of current interest are additional fertilizer, petrochemical, and synthetic fiber facilities, a color television plant, and a truck plant. In addition to complete plants, Peking continues to purchase large amounts of oil drilling and exploration equipment for onshore and offshore use and has inquired about computers, mining, and ore benefication equipment, and technology to upgrade its railroads. Besides hardware purchases, China has been pursuing increased technical exchanges with Japan and Western Europe.

The principal suppliers of foreign technology will continue to be Japan, West Germany, France, and other countries in Western Europe. Unless political conditions change, the United States will probably not obtain a major share of the plant contracts, but will continue to benefit from sales of U.S. technology embodied in plants sold by other countries and from sales of items where U.S. technology excels such as oilfield equipment and computers.

Beyond ideological and export growth considerations, there are other factors that will limit Chinese technology purchases. Competing demands for increased imports of industrial supplies and uncertainty over needs for agricultural imports will place limits on technology expenditures. An equally important constraint is China's limited capacity to absorb large amounts of advanced technology. Disruption of the education system in the past has created a shortage of technical manpower to install, operate, and maintain advanced equipment. Efforts now underway to correct this deficiency will take time to show results. Also, a large influx of plant and equipment will require complementary domestic investments to operate efficiently. As a result, technology purchases may follow the same pattern as in the earlier period with a large initial bulge of contracts followed by declining purchases to permit breathing space to digest the technology. Finally, strategic controls in the West such as Cocom restrictions will prevent China from acquiring certain high technology equipment.

2. INDUSTRIAL SUPPLIES

Unlike technology purchases with long delivery lags, China's imports of industrial supplies will turn upward immediately. These supplies will continue to constitute a substantial share of the import bill, as planned increases in industrial output create demands for such goods as steel, nonferrous metals, rubber, fertilizer, and chemicals. Import substitution, particularly as a result of plant imports, will serve more to hold down the growth in purchases of industrial supplies in the future than to actually reduce or eliminate imports of most of the commodities involved. The pattern of industrial imports will vary not only with China's needs, but also with world prices. As in the past, Peking will trim back purchases as much as possible when prices for individual commodities shoot up and will engage in some stockpiling when prices are depressed.

Metals will be the most important component, making up one-third or more of China's total imports. Steel is described by the Chinese as the key link and will be needed in growing quantities to support industrialization. The domestic steel industry has been a poor performer in recent years and, even with the recent and planned additions to capacity from foreign and domestic sources, demand will outstrip domestic supply. With imported steel plants coming on line, China will likely shift imports from basic shapes and forms toward higher quality and special steel products. The proposed Shangahi mill to be purchased from Japan will eventually yield some import substitution since imports of cheaper ore to supply the plant can be substituted for purchases of finished steel. Japan remains the dominant supplier and the large share that China holds in Japan's market for steel exports will continue to give Peking some leverage in price bargaining.

Copper and aluminum account for about 80 percent of China's nonferrous metals imports and this trend will continue. These two metals are vital inputs to the construction, transportation, and electric power industries and, as with steel, projected increases in domestic output will not keep pace with demand. Other nonferrous metals, particularly steel alloying materials such as nickel, cobalt, and chrome, of which China has very limited reserves, will also be needed in larger amounts in the future. Third World producer countries will be the major copper suppliers, and Peking will continue to purchase refined and semirefined copper and ores from these countries. Aluminum purchases will still come largely from the developed West.

Fertilizer imports through the 1980's will probably remain high despite the sharp increases in domestic capacity from imported plants. Over time, however, China may shift more toward imports of potassium and phosphoric fertilizers and away from nitrogen to obtain a better nutrient mix. Imports of other chemicals are likely to rise. Agricultural chemicals and insecticides will become more important and needs for chemicals for the plastics industry will increase.

As for rubber, imported plants may eliminate the need for synthetic rubber imports in the 1980's. Synthetic rubber, however, is not a good substitute for natural rubber in many uses. Consequently, imports of natural rubber will grow, especially to support the expanding transport sector.

3. AGRICULTURAL IMPORTS

Imports of agricultural products will continue to vary with the performance of the domestic agricultural sector. Grain imports, the major component of agricultural purchases, will fluctuate around the 5- to 6-million-ton level over the long term. Year-to-year purchases will depend on success of the previous year's harvest, and, to a lesser extent, on world supplies and prices. Wheat will be the grain of choice with corn filling out needs when world wheat supplies are tight. Canada and Australia remain the principal suppliers. Argentina will round out the suppliers in normal years and, under current PRC policy, the United States will be tapped only when grain supplies from other countries are inadequate. Wheat imports in 1978 may well top 7 million tons of which at least 1 million tons will be U.S. grain.

China has traditionally been a net exporter of soybeans, but limited growth prospects for oilseed production will probably require continued imports in the future. Soybean oil purchases will be made when prices are favorable. Brazil has emerged in the past few years as the principal source with the United States again in the role of residual supplier. Growing domestic needs for sugar may push imports to higher levels in the future. As in 1977, China will take advantage of low world prices to make large purchases of this commodity. After years of relying on Cuba for its sugar needs, China has diversified its purchases to a number of Third World suppliers.

The future for cotton imports is less certain. Cotton purchases in the 1970's have supplemented stagnant domestic production to supply textiles for both domestic and export needs. The sharp increase in China's synthetic textile fiber capacity in recent years should serve to hold down import demand for cotton in the years to come.

While Peking will seek to cut back on agricultural imports as much as progress in the domestic agricultural sector will allow, these are by and large not discretionary purchases. Sharp increases in agricultural imports, due to harvest setbacks, particularly if required during periods of tight world supplies and rising prices, may force Peking to reduce spending on other imports. Such events cannot be predicted, but the possibility may well inject a note of caution into Peking's trade plans. Grain credits will still be used to smooth out expenditures, but because they are short term they are of little help when import costs rise quickly.

C. The Finance Option

Use of credits for capital imports makes sense for the Chinese since it permits them to postpone payments for the equipment until it is installed and adding to domestic output. Peking's current financial policies remain quite conservative—no direct loans or buyer credits and no long-term borrowing. There are hints, however, that China may liberalize these policies somewhat in the future, although to what extent is not clear. Bank of China officials in discussions with Japanese and Western European bankers over the past year have been willing to explore the full range of financing options and have inquired about the terms available. Peking has also stated, ambiguously, its intention to use "customary" practices in foreign trade and finance.

To date no action has been taken in the credit area. For the future China will probably ease its policy to permit the use of longer term credits and other forms of borrowing such as deposits by foreign banks with the Bank of China but will continue to maintain its no-debt facade for ideological purposes. Deposits with the Bank of China have been discussed with the West Europeans and are under consideration with the Japanese. Also, under the long-term agreement the Japanese are considering a scheme of advanced payments for Chinese oil and coal exports to finance plant imports. One area of concern to the Chinese is interest rates on government-guaranteed credits. The developed countries are bound by the "gentlemen's agreement" on export financing, which puts a floor of 7.25 percent on credits for sales to China. Peking has been pressuring the Japanese, in particular, for lower interest rates on Export-Import Bank credits, and negotiations are underway to resolve the issue.

If China decides to seek larger or longer term credits, financing would be available. Peking has an excellent credit rating, and its finances are in good shape after 2 years of billion-dollar trade surpluses. Western bankers would also be willing to make credit arrangements so as to keep within Peking's definition of deferred payments and normal business practices.

Through increased use of credits China would be able to support a substantial capital import program. As an example, assume that Peking purchases $3 billion worth of plants each year for 1978–82 and that exports to the non-Communist countries increase at an average rate of 10 percent per annum. With a 7-percent interest rate and continued use of 5-year credits China's debt service to export ratio would remain within safe limits, rising from 6 percent in 1981 to a peak of 18 percent in 1985. Even if down payment expenditures were included, the debt service ratio would hit only 20 percent. If Peking were to accept a 10-year credits the debt service ratio would range from 4 to 11 percent from 1981 to 1985, and including downpayments would peak at only 15 percent. Admittedly, other factors such as competing import needs, actual export performance, absorptive capacity, and even China's willingness to incur that much debt will determine the size and pace of the technology import program. Use of import financing, however, will give Peking ample flexibility.

In addition to credits, China could explore alternate forms of financing for capital imports in the future. Barter arrangements would have appeal, since an export market for the goods necessary to pay for the equipment would be secured at the time of purchase and the deal would minimize the use of hard currency. Another method would be compensation agreements whereby the supplier agrees to take payment from the output of the plant, making the purchase self-liquidating. Finally, joint ventures would be useful, because the supplier bears a share of the risk in the project in hope of sharing in the output. Barter deals are familiar to the Chinese and would probably be acceptable. Finding willing suppliers and suitable barter commodities, however, often present problems for large deals. Compensation agreements and joint ventures would present policy problems. Peking has been critical of compensation deals arranged by other countries, particularly the U.S.S.R., and at present rules out any joint ventures as economic exploitation. China could probably perform the necessary semantic gymnastics to square such deals with self-reliance, and the prospects for some arrangements of this sort in the future appear more favorable.

APPENDIX STATISTICAL TABLES

TABLE A-1.—CHINA: BALANCE OF TRADE[1]

[In million U.S. dollars]

	Total trade				Communist countries				Non-Communist countries			
	Total	Exports	Imports	Balance	Total	Exports	Imports	Balance	Total	Exports	Imports	Balance
1950	1,210	620	590	30	350	210	140	70	860	410	450	−40
1951	1,900	780	1,120	−340	975	465	515	−50	920	315	605	−290
1952	1,890	875	1,015	−140	1,315	605	710	−105	575	270	305	−35
1953	2,295	1,040	1,255	−215	1,555	670	885	−215	740	370	370	0
1954	2,350	1,060	1,290	−230	1,735	765	970	−205	615	295	320	−25
1955	3,035	1,375	1,660	−285	2,250	950	1,300	−350	785	425	360	65
1956	3,120	1,635	1,485	150	2,055	1,045	1,010	35	1,065	590	475	115
1957	3,055	1,615	1,440	175	1,965	1,085	880	205	1,090	530	560	−30
1958	3,765	1,940	1,825	115	2,380	1,280	1,100	180	1,385	660	725	−65
1959	4,290	2,230	2,060	170	2,980	1,615	1,365	250	1,310	615	695	−80
1960	3,990	1,960	2,030	−70	2,620	1,335	1,285	50	1,370	625	745	−120
1961	3,015	1,525	1,490	35	1,685	965	715	250	1,335	560	775	−215
1962	2,670	1,520	1,150	370	1,410	915	490	425	1,265	605	660	−55
1963	2,775	1,575	1,200	375	1,250	820	430	390	1,525	755	770	−15
1964	3,220	1,750	1,470	280	1,100	710	390	320	2,120	1,040	1,080	−40
1965	3,880	2,035	1,845	190	1,165	650	515	135	2,715	1,385	1,330	55
1966	4,245	2,210	2,035	175	1,090	585	505	80	3,155	1,625	1,530	95
1967	3,915	1,960	1,955	5	830	485	345	140	3,085	1,475	1,610	−135
1968	3,785	1,960	1,825	135	840	500	340	160	2,945	1,460	1,485	−25
1969	3,895	2,060	1,835	225	785	490	295	195	3,110	1,570	1,540	30
1970	4,340	2,095	2,245	−150	860	480	380	100	3,480	1,615	1,865	−250
1971	4,810	2,500	2,310	190	1,085	585	500	85	3,725	1,915	1,810	105
1972	6,000	3,150	2,850	300	1,275	740	535	205	4,725	2,410	2,315	95
1973	10,300	5,075	5,225	−150	1,710	1,000	710	290	8,590	4,075	4,515	−440
1974	14,080	6,660	7,420	−760	2,435	1,430	1,010	420	11,645	5,230	6,415	−1,185
1975	14,575	7,180	7,395	−215	2,390	1,380	1,010	370	12,185	5,800	6,385	−585
1976	13,255	7,250	6,005	1,245	2,345	1,240	1,105	135	10,915	6,015	4,900	1,115

[1] Data are rounded to the nearest $5,000,000. Because of rounding, components may not add to totals shown.

Source: Central Intelligence Agency, National Foreign Assessment Center, "China: International Trade, 1976–77" Washington, D.C., November 1977.

TABLE A-2.—CHINA: EXPORTS BY AREA AND COUNTRY, F.O.B.[1]

[In million U.S. dollars]

	1970	1971	1972	1973	1974	1975	1976
Total	2,095	2,500	3,150	5,075	6,660	7,180	7,250
Non-Communist countries	1,615	1,915	2,410	4,075	5,230	5,800	6,015
Developed countries	675	810	1,085	1,825	2,415	2,620	2,695
East Asia and Pacific	300	365	530	1,025	1,390	1,565	1,420
Of which:							
Australia	40	42	55	86	121	86	102
Japan	255	322	468	918	1,241	1,459	1,306
Western Europe [2]	355	410	475	685	850	840	985
Of which:							
France	57	67	91	128	160	150	169
Italy	56	56	73	111	102	112	135
Netherlands	25	35	39	57	84	70	78
Switzerland	18	23	17	25	31	27	32
United Kingdom	69	69	77	102	136	112	136
West Germany	70	89	92	130	168	195	236
North America	20	35	80	115	175	215	290
Of which:							
United States	(3)	5	32	64	115	158	202
Canada	22	28	49	53	62	55	90
Less-developed countries	940	1,105	1,325	2,250	2,815	3,180	3,320
Hong Kong and Macao	485	570	710	1,135	1,220	1,400	1,630
Of which:							
Hong Kong [4]	468	550	684	1,094	1,190	1,372	1,590
Southeast Asia	160	190	250	485	565	680	660
Of which:							
Indonesia	31	26	37	46	108	194	125
Malaysia [5]	120	150	170	320	186	106	97
Singapore [5]					225	252	254
South Asia	70	60	40	100	240	210	180
Of which:							
Iran	0	0	0	20	106	51	89
Pakistan	26	33	23	46	52	51	62
Sri Lanka	46	26	15	31	65	89	6
Middle East	75	75	90	160	245	320	275
Of which:							
Iraq	22	19	19	35	48	65	41
Kuwait	19	20	24	34	44	52	64
Syria	8	9	16	21	44	39	31
North Africa	45	70	70	80	90	130	110
Of which:							
Egypt	13	15	22	22	16	50	39
Morocco	10	10	16	13	18	24	19
Sub-Saharan Africa	95	130	145	235	395	390	410
Of which:							
Nigeria	18	26	24	33	44	63	108
Sudan	11	20	23	26	58	42	26
Tanzania	33	76	64	88	79	71	38
Zambia	3	6	14	15	37	34	25
Latin America	10	10	20	55	60	45	55
Of which:							
Argentina	1	1	(3)	(3)	0	1	(3)
Brazil	0	1	1	2	1	1	(3)
Chile	(3)	(3)	3	16	12	4	16
Peru	(3)	(3)	(3)	1	0	8	15
Communist countries	480	535	740	1,000	1,430	1,380	1,240
U.S.S.R	22	76	134	136	139	150	178
Eastern Europe	165	195	230	305	405	485	435
Of which:							
Czechoslovakia	25	25	28	44	58	58	50
East Germany	36	39	50	59	78	103	96
Hungary	13	14	20	26	30	56	31
Poland	24	21	34	34	48	43	40
Romania	62	89	96	136	182	215	201
Far East	125	150	180	355	580	540	460
Other [6]	170	165	196	205	305	200	165

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[1] Series are reconstructed from U.S. Central Intelligence Agency, "People's Republic of China: International Trade Handbook", Washington, D.C., October 1973, September 1974, October 1975, October 1976; CIA, "China: International Trade, 1976–77," November 1977; and from International Monetary Fund, Bureau of Statistics, "Direction of Trade," tapes. Value data for individual countries are rounded to the nearest $1,000,000; for regions, to the nearest $5,000,000. Components may not add to the totals shown because of rounding.

[2] Includes Spain, Portugal, Greece, and Malta.

[3] Negligible.

[4] Includes Hong Kong re-exports of PRC-origin goods to third countries. No attempt has been made to assign these re-exports to the country of ultimate destination. Although some double counting may result from this procedure, most of these reexports probably are not recorded as an import from China in the trade partner statistics.

[5] See source for methodology used to eliminate double counting of reexports to Malaysia through Singapore for 1970–73 data.

[6] Consists of Yugoslavia, Albania, and Cuba

TABLE A-3.—CHINA: IMPORTS BY AREA AND COUNTRY, C.I.F.[1]

[In million U.S. dollars]

	1970	1971	1972	1973	1974	1975	1976
Total	2,245	2,310	2,850	5,225	7,420	7,395	6,005
Non-Communist countries	1,865	1,810	2,315	4,515	6,415	6,385	4,900
Developed countries	1,555	1,430	1,670	3,525	5,305	5,480	4,110
East Asia and Pacific	740	640	690	1,265	2,470	2,740	2,050
Of which:							
Australia	135	29	49	161	357	355	278
Japan	600	607	640	1,089	2,086	2,369	1,746
Western Europe[2]	660	575	605	1,040	1,370	1,970	1,690
Of which:							
France	97	125	67	103	189	434	402
Italy	76	71	88	87	121	168	143
Netherlands	33	25	12	37	72	153	46
Switzerland	23	19	22	48	63	65	60
United Kingdom	143	92	90	238	192	204	141
West Germany	200	160	190	356	484	601	716
North America	155	215	375	1,220	1,460	770	370
Of which:							
United States	(3)	(3)	79	862	949	334	149
Canada	154	213	296	356	513	435	219
Less developed countries	310	380	645	990	1,110	905	795
Hong Kong and Macao[4]	10	10	20	55	60	35	30
Of which:							
Hong Kong	11	10	18	53	59	33	30
Southeast Asia	65	50	90	205	200	155	200
Of which:							
Indonesia	0	0	0	0	5	5	(3)
Malaysia	23	19	28	85	91	55	49
Singapore	24	16	21	56	54	44	40
South Asia	85	65	50	70	65	125	100
Of which:							
Iran	NA	NA	NA	NA	7	28	6
Pakistan	41	32	18	14	12	14	10
Sri Lanka	44	32	27	39	42	68	68
Middle East	25	15	90	140	140	130	150
Of which:							
Iraq	6	3	3	0	40	71	50
Kuwait	0	0	0	18	23	4	11
Syria	18	7	21	33	48	26	48
North Africa	40	65	65	80	115	80	65
Of which:							
Egypt	13	30	29	22	39	23	59
Morocco	10	21	22	31	29	7	3
Sub-Saharan Africa	80	120	120	170	135	130	100
Of which:							
Nigeria	1	1	5	8	6	8	5
Sudan	19	34	39	71	37	41	27
Tazania	9	13	21	15	14	16	15
Zambia	52	49	19	23	37	22	26
Latin America	5	55	210	270	390	250	150
Of which:							
Argentina	3	7	3	18	115	22	3
Brazil	1	(3)	77	72	21	74	10
Chile	0	20	79	105	117	14	50
Peru	0	25	47	42	79	70	55
Communist countries	380	500	535	710	1,010	1,010	1,105
U.S.S.R	25	78	121	136	143	129	238
Eastern Europe	190	250	265	300	360	525	550
Of which:							
Czechoslovakia	31	34	29	40	46	70	70
East Germany	42	44	48	50	70	117	104
Hungary	8	17	33	39	24	41	40
Poland	26	37	28	33	45	60	66
Romania	72	99	122	129	168	220	252
Far East	65	75	80	125	155	200	160
Other[5]	100	95	70	150	350	155	155

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[1] Series are reconstructed from U.S. Central Intelligence Agency, "People's Republic of China: International Trade Handbook," Washington, D.C., October 1973, September 1974, October 1975, October 1976; CIA, "China: International Trade, 1976–77," November 1977; and from International Monetary Fund, Bureau of Statistics, "Direction of Trade," tapes. Value data for individual countries are rounded to the nearest $1,000,000; for regions, to the nearest $5,000,000. Components may not add to the totals shown because of rounding.

[2] Includes Spain, Portugal, Greece, Malta.

[3] Negligible.

[4] Includes Hong Kong reexports of third country goods to China. No attempt has been made to assign these reexports to the country of origin. These reexports probably are not included in third country trade statistics because they are sold directly to Hong Kong merchants, not on a through bill of lading to China.

[5] Consists of Yugoslavia, Albania, and Cuba.

TABLE A-4.—AGGREGATE DOLLAR PRICE AND TERMS OF TRADE INDEXES FOR CHINA'S TRADE WITH NON-COMMUNIST COUNTRIES [1]

[1970=100]

	1970	1971	1972	1973	1974	1975	1976
Export price indexes:							
All exports	100	102.0	110.6	152.0	209.4	204.3	185.0
Sectors of origin:							
Agriculture	100	101.4	111.7	161.3	199.8	185.8	175.4
Extraction [2]	100	85.8	88.6	113.2	371.2	446.1	429.9
Manufacturing	100	104.1	111.0	147.6	198.7	185.3	170.4
End use:							
Foodstuffs	100	103.0	115.3	161.7	206.5	193.8	191.3
Industrial supplies [2]	100	100.2	106.0	152.9	228.4	227.0	197.6
Capital goods	100	98.8	98.6	115.4	128.9	156.5	145.5
Consumer goods	100	105.9	116.9	144.6	191.4	186.9	160.4
Import price indexes:							
All imports	100	92.4	94.6	121.9	183.8	190.7	163.1
Sectors of origin:							
Agriculture	100	111.9	123.6	159.1	284.5	280.2	244.4
Extraction	100	75.5	76.3	141.9	215.4	141.9	155.5
Manufacturing	100	89.1	86.6	107.1	158.8	181.5	154.8
End use:							
Foodstuffs	100	111.4	122.3	178.8	286.5	301.4	269.6
Industrial supplies	100	88.8	87.5	107.2	168.4	174.0	145.1
Capital goods	100	95.2	98.4	134.6	165.5	201.8	190.0
Consumer goods	100	84.7	124.1	148.8	153.1	204.4	155.0
Terms of trade indexes:							
Community [3]	100	110.4	116.9	124.7	113.9	107.1	113.4
Income [4]	100	128.3	157.7	207.0	176.2	186.2	228.3

[1] Data are reconstructed from CIA, National Foreign Assessment Center (NFAC), "China: Real Trends in Trade with Non-Communist Countries Since 1970," October 1977, and from CIA, NFAC, "China: International Trade, 1976–77,' November 1977. The price indexes are of the Paasche variety, using current year weights.

[2] Including price effects of crude oil exports.

[3] Commodity terms of trade is the export price index divided by import price index.

[4] Income terms of trade is the commodity terms of trade index multiplied by the export quantity index. The income terms of trade is a measure of the "capacity to import" based on exports. It is not a measure of the total capacity to import, which depends not only on export but also on capital inflows and other invisible exchange receipts.

TABLE A-5.—CHINA: EXPORTS TO NON-COMMUNIST COUNTRIES [1]

[In million U.S. dollars]

	1970	1971	1972	1973	1974	1975	1976
CURRENT DOLLARS [2]							
Total	1,615	1,915	2,410	4,075	5,230	5,800	6,015
Sectors of orgin:							
Agriculture	839	977	1,242	1,847	2,169	2,377	2,308
Extraction	60	64	62	122	545	910	675
Manufacturing	716	873	1,108	2,106	2,516	2,512	3,031
End use:							
Foodstuffs	592	701	844	1,218	1,662	1,930	1,737
Industrial supplies	714	836	1,070	1,894	2,492	2,722	2,891
Capital goods	52	80	80	127	157	283	246
Consumer goods	257	298	415	836	919	866	1,140
1970 DOLLARS [3]							
Total	1,615	1,877	2,179	2,681	2,498	2,839	3,251
Sectors of origin:							
Agriculture	839	964	1,112	1,145	1,086	1,279	1,316
Extraction	60	75	70	108	147	204	157
Manufacturing	716	839	998	1,427	1,266	1,354	1,779
End use:							
Foodstuffs	592	681	732	753	805	996	908
Industrial supplies	714	834	1,009	1,239	1,091	1,199	1,463
Capital goods	52	81	81	110	122	181	169
Consumer goods	257	281	355	578	480	463	711

[1] Data are reconstructed from CIA, National Foreign Assessment Center (NFAC), "China: Real Trends in Trade with Non-Communist Countries Since 1970," October 1977, and from CIA, NFAC, "China: International Trade, 1976–77," November 1977.

[2] Data are estimated from the official trade statistics of reporting countries, adjusted to reflect Chinese exports, f.o.b. Estimates probably are accurate only to ±5 percent. Because of rounding, components may not add to totals shown.

[3] Data are derived by dividing the current dollar values of exports by the corresponding Paasche price indexes. Sampling error alone could be as great as ±15 percent. Because of rounding, components may not add to totals shown.

TABLE A-6.—CHINA: IMPORTS FROM NONCOMMUNIST COUNTRIES, F.O.B.[1]

[In million U.S. dollars]

	1970	1971	1972	1973	1974	1975	1976
CURRENT DOLLARS[2]							
Total	1,707	1,664	2,102	4,036	5,783	5,865	4,310
Sectors of origin:							
Agriculture	379	362	637	1,310	1,646	947	594
Extraction	88	86	93	245	219	196	189
Manufacturing	1,240	1,216	1,372	2,481	3,918	4,722	3,526
End use:							
Foodstuffs	283	221	419	887	1,239	639	399
Industrial supplies	1,117	1,127	1,364	2,514	3,120	3,471	2,661
Capital goods	294	301	301	598	1,380	1,721	1,223
Consumer goods	13	14	18	37	44	34	26
1970 DOLLARS[3]							
Total	1,707	1,801	2,222	3,312	3,146	3,076	2,643
Sectors of origin:							
Agriculture	379	324	515	823	579	338	243
Extraction	88	114	122	173	102	138	122
Manufacturing	1,240	1,365	1,584	2,317	2,467	2,602	2,278
End use:							
Foodstuffs	283	198	343	496	432	212	148
Industrial supplies	1,117	1,269	1,559	2,345	1,853	1,995	1,834
Capital goods	294	316	306	444	834	853	644
Consumer goods	13	17	15	25	29	17	17

[1] Data are reconstructed from CIA, National Foreign Assessment Center (NFAC), "China: Real Trends in Trade with Non-Communist Countries Since 1970," October 1977, and from CIA, NFAC, "China: International Trade, 1976–77," November 1977.

[2] Estimates probably are accurate only to ±5 percent. Because of rounding, components may not add to totals shown.

[3] Data are derived by dividing the current dollar values of imports by the corresponding Paasche price indexes. Sampling error alone probably amounts to ±5 percent, and homogeneity error cannot be estimated. Because of rounding, components may not add to totals shown.

TABLE A-7.—CHINA: COMMODITY COMPOSITION OF EXPORTS F.O.B., BY SECTOR OF ORIGIN[1]

[In million U.S. dollars]

	1970	1971	1972	1973	1974	1975	1976
Total	2,095	2,500	3,150	5,075	6,660	7,180	7,250
Agricultural	980	1,160	1,470	2,175	2,585	2,855	2,670
Of which:							
Live animals	65	90	110	135	195	215	230
Meat and fish	150	185	225	335	335	415	430
Grain	110	95	155	445	715	720	450
Fruit and vegetables	170	155	180	245	315	360	385
Tea and spices	NA	NA	NA	NA	100	100	140
Oilseeds	65	65	70	110	135	140	85
Natural textile fibers	100	120	205	330	190	250	285
Crude animal materials	115	105	115	170	200	230	260
Extractive	115	130	165	240	705	1,095	830
Of which:							
Crude minerals	NA	NA	NA	NA	105	120	65
Coal	NA	NA	NA	NA	115	130	95
Crude oil	0	0	0	30	425	760	665
Manufacturing	1,005	1,210	1,515	2,660	3,370	3,225	3,755
Of which:							
Chemicals	105	130	160	255	400	300	330
Textile yarn and fabrics	340	325	460	855	940	1,065	1,235
Nonmetallic mineral products	NA	NA	NA	NA	105	140	150
Iron and steel	40	65	65	120	170	85	105
Nonferrous metals	25	45	30	60	75	120	90
Machinery	90	120	125	215	150	210	215
Transport equipment					105	130	70
Clothing	155	155	190	345	360	345	420
Handicrafts and light, manufactures	NA	NA	NA	NA	220	190	320

[1] Data are reconstructed from various issues of CIA, "People's Republic of China: International Trade Handbook", and from CIA, NFAC, "China: Real Trends in Trade with Non-Communist Countries Since 1970", October 1977. Commodities were distributed according to the sectoral groups designated in the latter publication. Data are rounded to the nearest $5,000,000.

TABLE A-8.—CHINA: COMMODITY COMPOSITION OF IMPORTS, C.I.F., BY END USE[1]

[In million U.S. dollars]

	1970	1971	1972	1973	1974	1975	1976
Total	2, 245	2, 310	2, 850	5, 225	7, 420	7, 395	6, 005
Foodstuffs	395	320	510	1, 080	1, 600	900	565
Of which:							
Grain	280	215	345	840	1, 180	675	325
Sugar	80	70	135	135	175	180	200
Oilseeds	0	0	10	65	160	15	5
Consumer durables	15	15	20	40	45	35	30
Of which: Watches	5	5	5	20	20	15	15
Industrial supplies	1, 460	1, 555	1, 875	3, 380	4, 125	4, 250	3, 570
Of which:							
Natural textile fibers	95	125	215	450	520	260	190
Synthetic textile fibers	15	15	25	35	95	95	115
Synthetic textile fabrics	45	40	40	110	170	85	125
Paper and paperboard	15	10	20	35	100	80	45
Rubber	80	60	70	170	165	155	155
Petroleum and products	NA	NA	NA	NA	75	105	45
Fertilizers, manufactured	140	135	145	210	220	405	230
Plastic materials	30	20	35	50	125	70	90
Metalliferous ores	NA	NA	NA	NA	110	125	125
Iron and steel	405	465	510	930	1, 210	1, 550	1, 445
Nonferrous metals	210	150	235	410	415	450	260
Metal products	NA	NA	NA	NA	85	125	90
Capital goods	375	420	445	725	1, 650	2, 210	1, 840
Of which:							
Machinery	195	215	210	310	770	1, 265	1, 300
Transport equipment	160	185	215	390	835	890	470
Precision instruments	15	10	15	15	40	50	60

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[1] Data are reconstructed from various issues of CIA, "People's Republic of China: International Trade Handbook." and from CIA, NFAC, "China: Real Trends in Trade with Non-Communist Countries Since 1970," October 1977. Commodities were distributed according to the end-use categories designated in the latter publication. Data are rounded to the nearest $5,000,000.

TABLE A-9.—CHINA: CONTRACTS FOR WHOLE PLANT IMPORTS

[Value in million U.S. dollars]

Nation/Firm: Type	Value	Contract signed	Completion	Comment
1973 Contracts	1,259			
Japan	461			
Toyo Engineering: Ethylene and butadiene.	50	February 1973	1978	Japan Ex-Im/Commercial bank financing.
Mitsubishi: Ethylene and poval	34	do	NA	Do.
Asahi Chemical: Acrylonitrile monomer.	30	March 1973	NA	Do.
Kuraray: Vinyl acetate and poval	26	do	1976	Do.
Toyo Engineering & Mitsui Toatsu: Urea and ammonia.	42	April 1973	NA	Do.
Toray & Mitsui Shipbuilding: Polyester chips.	50	May 1973	1976	Do.
Sumitomo: Benzene, toluene, and xylene.	5	do	NA	Cash deal.
Mitsubishi: Polyethylene, low pressure.	22	July 1973	1975	Japan Ex-Im, Commercial bank financing.
Sumitomo: Polyethylene, high pressure.	47	August 1973	1976	Do.
Hitachi, Ltd.: 2 thermal electric powerplants.	72	September 1973	1975	Do.
Toyo Engineering & Mitsui Toatsu: Urea and ammonia.	43	do	NA	Do.
Mitsui Petrochemical & Mitsui Shipbuilding: Polypropylene.	25	October 1973	1976	Do.
Nisso Petrochemical: Ethylene glycol.	15	December 1973	1976	Do.
France	400			
Alsthom: Hydroelectric turbines (2)	10	February 1973	NA	
Speichem: Vinyl acetate and methanol.	90	May 1973	1976	Consortium involving firms in France, West Germany, and the United Kingdom.
Technip & Speichem: Petrochemical complex.	300	September 1973	NA	French-led consortium probably involving other firms in Western Europe.

TABLE A-9.—CHINA: CONTRACTS FOR WHOLE PLANT IMPORTS—Continued

[Value in million U.S. dollars]

Nation/Firm: Type	Value	Contract signed	Completion	Comment
United States	205			
M. W. Kellogg:				
Ammonia plants (3)	75	March 1973	1976	Probable feedstock plants for the Dutch urea plants
Ammonia plants (5)	130	November 1973	1976-77	Probably progress payments; will provide feedstock for 5 Dutch urea plants.
Netherlands	89			
Kellog Continental:				
Urea plants (3)	34	February 1973	1976	Subsidiary of M. W. Kellogg.
Urea plants (5)	55	September 1973	1977	Do.
West Germany	4			
Friedrich Uhde & Hoechst: Acetaldehyde.	4	July 1973	NA	
United Kingdom	8			
Technicolor, Ltd.: Motion picture processing plant.	8	July 1973	NA	Cash deal.
Italy	79			
G.I.E.: Electric thermal powerplants (2).	79	November 1973	NA	5-yr financing.
Denmark	13			
Haldor Topsoe: Ammonia catalyst	13	December 1973	NA	
1974 contracts	**831**			
Japan	348			
Teijin: Polyester spinning	16	January 1974	NA	Japan Ex-Im/Commercial bank financing.
Toho Titanium: Polypropylene catalyst.	5	do	NA	Catalyst for Mitsui polypropylene plant.
Kuraray: Polyvinyl alcohol	19	February 1974	1976	Japan Ex-Im/Commercial bank financing.
Nisso Petrochemical: Synthetic fiber	14	March 1974	1976	
Nippon Steel and Hitachi: Hot strip rolling mill and silicon steel plate.	229	June 1974	1977	Demag supplying other part of the complex.
Nippon Steel: Ancillary equipment for steel mill.	65	October 1974	1977	Equipment for the hot strip mill.
West Germany	296			
Uhde: Vinyl Chloride monomer	19	January 1974	1976	
Demag: Cold rolling mill	200	March 1974	1977	Consortium of European firms led by Demag. Progress payment.
Uhde: Polyethylene	15	do	1976	
Demag: Continuous casting mill	57	August 1974	1977	Progress payment. Part of steel complex purchased from Japan and Germany.
Brown Boveri: Electrical substations	5	do	1977	
France	171			
Heurtey: Ammonia and urea complex (2).	120	February 1974	1977	5-yr credit financing.
Electromechanique: Thermal electric power plant.	41	April 1974	1976	
Rhone Poulenc: Nylon spinning	10	August 1974	1977	Progress payments.
Italy	16			
SNAM Progetti: Polypropylene	16	January 1974	NA	Do.
1975 contracts	**364**			
Japan	38			
Nippon Seiko: Spherical bearings	3	April 1975	1976	Do.
Koyo Seiko: Cylindrical bearings	8	do	1976	Do.
Ibigawa: Laminated board	1	July 1975	NA	
Ataka: Air separation	11	November 1975	1977	Progress payments; 35,000 m^3/hr capacity.
Mitsubishi: Friction materials	15	December 1975	NA	

TABLE A-9.—CHINA: CONTRACTS FOR WHOLE PLANT IMPORTS—Continued

[Value in million U.S. dollars]

Nation/Firm: Type	Value	Contract signed	Completion	Comment
West Germany	90			
Linde: Benzene	20	July 1975	NA	
Krupp: Dimethylterephthalate	50	December 1975	NA	Progress payments; 90,000 tons per year capacity.
Uhde: Ethanol	20	do	NA	100,000 metric tons per year capacity.
United Kingdom	200			
Rolls Royce: Jet engine plant	200	December 1975	1980	50 jet engines plus manufacturing facility and testing equipment.
Italy	36			
Mechaniche Moderne: Detergent	1	September 1975	NA	Progress payments.
Eurotechnica: Detergent alkalation	35	October 1975	NA	Deferred payments.
1976 contracts	**185**			
Japan	146			
Japan Gasoline: Aromatics complex	36	January 1976	NA	Japan Ex-Im Bank financing.
Japan Synthetic Rubber: Styrene-butadiene rubber.	27	February 1976	NA	5-yr Japan Ex-Im bank financing; 240,000 metric tons per year capacity.
Kyokuto Boeki Kaisha: Hot scarfer	2	March 1976	NA	Progress payments.
Teijin: Polyester/polymer	40	do	NA	5-yr Japan Ex-Im bank financing; 80,000 metric tons per year capacity.
Nakajima Seiki: Wallpaper plant	1	April 1976	NA	
Nippon Steel: Desulfurization plant	26	June 1976	NA	
Mitsui: Cinder pelletizing	14	August 1976	NA	
West Germany	31			
BASF: Diethylhexonol	24	March 1976	NA	50,000 metric tons per year capacity.
Kraus Maffei: High reactive lime	7	August 1976	NA	
Italy	8			
Nuovo Pignone: Centrifugal compressors technology.	8	June 1976	NA	
Finland	NA			
Tamglass: Automobile glass plant	NA	June 1976	NA	
1977 contracts	**59**			
Japan	20			
Chiyoda: Natural gas refining	20	November 1977	1980	5-yr Japan Ex-Im bank financing.
West Germany	39			
Zimmer: Polyester fiber and film	12	June 1977	1980	
Lurgi: Terephthalic acid	27	do	1980	U.S. technology from Amoco.

Sources: Central Intelligence Agency, Research Aid, "People's Republic of China: International Trade Handbook", Washington, D.C., October 1976, table 11, and CIA, National Foreign Assessment Center, "China: International Trade, 1976–77", Washington, D.C., November 1977, table 11.

TABLE A-10.—CHINA: FOREIGN DEBT POSITION,[1] 1970–76

[In million U.S. dollars]

	1970	1971	1972	1973	1974	1975	1976
Short-term credits:[2]							
Drawn	275	240	240	530	840	920	225
Repaid	325	305	175	230	655	830	915
Net	−50	−65	65	300	185	90	−690
Interest[3]	30	30	15	20	50	65	100
Outstanding	325	260	325	625	810	900	210
Medium-term credits:[4]							
Drawn					215	560	285
Repaid							25
Net					215	560	260
Interest[5]							5
Outstanding					215	775	1,035
Totals:							
Drawn	275	240	240	530	1,055	1,480	510
Repaid	325	305	175	230	655	830	940
Net	−50	−65	65	300	400	650	−430
Interest	30	30	15	20	50	65	105
Outstanding	325	260	325	625	1,025	1,675	1,245

[1] All data are estimates based on contract terms, delivery schedules, and trade statistics and are rounded to the nearest $5,000,000.

[2] 6- to 18-mo credits for grain, for Japanese fertilizer in 1970 and for Japanese steel in 1975.

[3] Estimated at 8 percent per annum 1970–74, 10 percent 1975–76.

[4] 5-yr credits for complete plant purchases.

TABLE A-11.—CHINA: FINANCIAL BALANCE WITH NON-COMMUNIST COUNTRIES, 1970–76

[In millions U.S. dollars]

	1970	1971	1972	1973	1974	1975	1976
Trade balance (f.o.b.)	−90	250	310	40	−555	−65	1,705
Net services and transfers[1]	−30	−15	−40	−240	−370	neg.	−15
Current account balance	−120	235	270	−200	−925	−65	1,690
Debt service[2]	−355	−335	−190	−250	−705	−895	−1,045
Supplier credit drawings[3]	275	240	240	530	1,055	1,480	510
Financial gap	−200	140	320	80	−575	520	1,155

[1] Net total of estimated transport costs, overseas remittances, downpayments for plants, and foreign aid.
[2] From table A-10, principal and interest.
[3] From table A-10, includes short-term and medium-term supplier credits.

THE SINO-AMERICAN COMMERCIAL RELATIONSHIP

By Martha Avery and William Clarke

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A. OVERVIEW

Since 1975, trade has continued to be an active element in the Sino-American relationship. The absence of normalized relations, however, and the unresolved nature of the linked claims and assets issues, the continued tariff discrimination, and the inability of the PRC to utilize Export-Import Bank facilities should they wish to do so, have all hampered the fuller development of trade and commerce. Despite these constraints, trade will grow in 1978 and the increased exchange of trade delegations augurs well for further development of the commercial relationship as called for by the Shanghai communique.

During his term in office, President Ford reconfirmed U.S. support of the Shanghai communique and normalization of relations. He traveled to Peking in December 1975. In February 1977, President Carter affirmed the new administration's support of the communique and the desirability of normalization. In pursuit of this objective, the President sent Secretary Vance to Peking in August 1977.

In January 1975, passage of the Trade Act of 1974 brought into law a variety of requirements that had the potential for affecting the newly developing Sino-American trade by adding to the requirements the PRC would have to meet if full normalization of the commercial relationship were to occur. Extension of most favored nation (MFN) tariff treatment and availability of Export-Import Bank loans are controlled by the requirements of the act. At this time, it seems unlikely that the PRC would discuss these requirements, at least prior to negotiations over full normalization.

Trade, which had peaked in 1973 and 1974, was down to more modest levels in 1976 and 1977. The United States ran balance-of-trade deficits with the PRC in both these years. A gradual and generally steady growth in levels of both Chinese exports and U.S. exports of non-agricultural commodities, however, points to a commercial relationship moving forward at a realistic pace. The resumption of agricultural sales in 1977 bodes well for further increases. Two-way trade in 1978 should reach $1 billion, up nearly 270 percent from 1977; the U.S. surplus should reach $300 to $400 million.

At times the export by China of various commodities has held a potential for disrupting the U.S. market with a resulting U.S. imposition of quotas. Chinese textile exports in late 1975 reached levels that raised calls for quotas, but shipments dropped in 1976 and no actions were taken. In late 1977, the first test case of market disruption under the Trade Act of 1974 occurred when a petition alleged disruption caused by export of cotton work gloves to the United States. The International Trade Commission ruled against the petition in March 1978.

Another development that has gained momentum since 1975, particularly since the arrest of the Gang of Four in late 1976, has been the technical seminar type of trade delegation. Both associations and individual firms were invited to Peking in increasing numbers during 1977. For the Chinese, the seminar provides information on the latest technology while the Americans view the seminar as a selling technique. The number of these visits appears to be increasing as the PRC moves toward more purchases of Western plant and technology to support their drive for the modernization of industry.

In the use of the seminar and in other ways more U.S. firms are introducing their products to China and laying the foundation for a continuing and mutually beneficial exchange of trade. While a sober appraisal of progress to date shows that trade has been less spectacular and more difficult than expected, it is also recognized that more U.S. businessmen are traveling to China each year and more Chinese delegations are arriving here as the process of expanding commerce in accord with the Shanghai communique continues.

B. Commercial Relations: Continued

Relations Resumed

President Nixon's trip to China in February 1972 was the culmination of an American initiative begun in 1969 to reopen a relationship interrupted in 1950 by the Korean hostilities. Step-by-step American moves selectively removing passport restrictions, removing certain minor controls on trade, and amending certain bunkering restrictions during 1969 and 1970 were precursors of the more significant actions of 1971. In that year, the United States removed all restrictions on travel to China, removed controls on the use of dollars in transactions with the PRC, extended bunkering authorizations, and in April 1971 announced an intention of ending the 21-year-old embargo.

The first Chinese response to our 1969 overture was Peking's invitation in April 1971 to the American ping pong team. Subsequently the United States terminated the embargo, placing a large number of commodities for export to the PRC under general licensing requirements. In July 1971, the President announced his intention of visiting China and in October the United Nations voted to seat the People's Republic of China.

The President's visit produced the Shanghai communique which remains to this date the foundation of U.S. policy toward China. In further steps during 1972, the United States placed the PRC in the same category as the U.S.S.R. and certain East European countries for export control purposes.[1]

Trade Expands

Regarding commercial relations the Shanghai communique said:

> Both sides view bilateral trade as another area from which mutual benefits can be derived and agree that economic relations based on equality and mutual benefit are in the interest of the peoples of the two countries. They agree to facilitate the progressive development of trade between the two countries.

In 1973, the opening of the U.S. Liaison Office (USLO) in Peking and the PRC Liaison Office (PRCLO) in Washington facilitated commercial relations. At the same time, these relations were also encouraged by the creation of the National Council for United States-China Trade.

During 1973 and 1974, trade between the two countries rose very rapidly to $805.1 and $933.8 million, respectively. The United States ran highly favorable trade balances owing to the large sales of wheat and other agricultural products. Also noteworthy at this time were the sales to China of commercial jet transport aircraft, about $150 million, and of eight ammonia (fertilizer) plants, over $200 million.

In 1973, American exporters had shipped $24.2 million in steel scrap to China, but when U.S. short supply controls were imposed on July 2, 1973, the PRC was given only a small allocation based on historical patterns of shipment. These U.S. controls were terminated on December 31, 1974, but scrap imports never recovered to precontrol levels despite the demonstrable requirements of the Chinese steel industry. Shipments in 1976 and 1977 totaled only $4.3 million.

Passage of the trade Act of 1974 brought into law a variety of requirements that had the potential for affecting the newly developing Sino-American trade by adding to the requirements the PRC would have to meet if full normalization of the commerical relation was to occur. Under the act, the President is authorized to extend non-discriminatory tariff treatment (MFN or most-favored-nation treatment) as part of a bilateral commercial agreement to nonmarket economy countries not currently receiving such treatment. Certain conditions set forth in the Trade Act preclude such a bilateral agreement, however, if the President determines that the country impedes its citizens from exercising the right or opportunity to emigrate. The President is authorized to waive by Executive order these conditions for a period of 18 months if he reports to Congress that the waiver will substantially promote the free emigration objectives. A negotiated bilateral commerical agreement resulting from such a waiver must contain various specific provisions, including safeguard arrangements and consultative mechanisms in cases of market disruption, patent and trademark protection not less than the rights specified in the Paris convention for the protection of industrial property, copyright protection not less than that afforded by the Universal Copyright Convention, provisions for the promotion of trade, and others. At this time, it seems somewhat unlikely that the PRC would even discuss these requirements, at least prior to negotiations over full normalization of relations.

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[1] For a chronology of the events described above see the appendix. For additional detail also see William W. Clarke and Martha Avery, "The Sino-American Commercial Relationship" in Joint Economic Committee compendium on China, *China: A Reassessment of the Economy*, Washington, D.C., 1975, pp. 500-534.

American Delegations Begin

The year 1975 was marked by the first visits to the United States of delegations from the PRC's foreign trade corporations and by the visit of a delegation from the China Council for the Promotion of International Trade (CCPIT). The CCPIT trip was in return for the National Council's (NCUSCT) visit of mid-1973. The 22-month interval between the two trips, unexpectedly long by early American expectations, probably reflected a reservation on the part of the Chinese about moving ahead too rapidly in the commercial sector without commensurate progress in the political arena. Besides the CCPIT visit, four other Chinese delegations arrived during the year and the first two American technical seminar type trade delegations visited Peking.

In December 1975, President Ford traveled to the PRC, where discussions centered on international affairs, although outstanding issue of commerical concern were also reviewed. President Ford reaffirmed the determination of the United States to complete the normalization of relations with the PRC on the basis of the Shanghai communique, which Vice Premier Teng Hsiao-ping described as remaining "full of vitality." According to the Department of State, discussions in Peking significantly promoted the objectives which the United States and the PRC share with regard to both our bilateral relations and the international scene. American exports for the year, however, were only 37 percent of exports in 1974.

Despite the low level of Sino-United States trade in general, during the last quarter of 1975 exports of Chinese cotton textiles to the United States increased so dramatically that strong concerns were voiced by the domestic textile industry, U.S. imports in 1975 were 169 percent over 1974. Since the Chinese, unlike all our other major textile trading partners, do not participate in the GATT Multi-Fiber Arrangement, discussion in the administration during the winter of 1976 centered on the possibility of having to place quotas on certain categories of Chinese cotton textiles. Quotas were not applied, however, because Chinese exports declined significantly in 1976. This was either due to increased prices or to a unilateral PRC decision to reduce shipments to avert triggering the imposition of quotas.

Four more Chinese trade corporation delegations visited the United States in 1976, including one group from the China National Technical Import Corporation which proceeded to negotiate purchase contracts for American machine tools. In contrast to this group, most of the Chinese delegations calling in the United States in 1975–76 did so with the objective of becoming better acquainted with the potential of the American market for Chinese commodities.

By 1976 it became apparent that U.S. trade groups being invited to China were falling into two general categories: the tourist/business type delegation whose direct commercial exposure to the trade corporations was limited, and the technical seminar, or as the Chinese term them, the technical exchange delegation. At the same time, individual American exporters calling in Peking were usually responding either to an invitation to present a technical seminar, or to an invitation to negotiate terms of an unsolicited proposal they had sent earlier.

The second National Council delegation of board members arrived in Peking in October 1976. Despite the flurry of commercial exchanges, two-way trade fell to a new low of $336 million and the United States ran its first deficit with the PRC, a deficit of $75.6 million.

In December 1976 the United States-Republic of China Economic Council was created in Chicago. American firms who agreed to become board members of the new council found that the Chinese apparently regarded acceptance of board membership as a "political," not a commercial act. As a consequence, commercial contact with the PRC for some of these firms became very difficult.

Recent Events

In February 1977, President Carter affirmed the new administration's support of the Shanghai communique when he said:

> Our policy toward the People's Republic will be guided by the Shangahi Communique and normalization is its goal. I believe the United States and the People's Republic have common interests in many places in the world. Given these and our bilateral interests, I look forward to strengthening cooperation between our two countries.

A few days earlier, Secretary Vance had noted that normalization of relations entailed diplomatic recognition of Peking.

The exchange of trade delegations increased noticeably in 1977 with six Chinese groups arriving here, including an important second visit by the CCPIT. Nine U.S. trade delegations visited the PRC including two associations presenting a series of technical seminars for the second time.

In late August, Secretary Vance made the first call in the PRC by the new adminstration. At the close of his visit after meeting with Chairman Hua and Vice Premier Teng, the Secretary said:

> We have had a very serious and candid exchange of views on many important issues, global and bilateral. I believe we have enhanced our mutual understanding and confirmed important points of common interest.
>
> In the Administration's first comprehensive consultations with the Chinese leadership I made clear that the starting point of our policy is that we remain committed to the Shanghai Communique and to progress toward the goal of full normalization of relations.

In response to the Secretary, the Foreign Minister of China, Huang Hua, said:

> China and the United States have different social systems, our two sides have different ideologies, and naturally there are differences of principle between us, but in the present international situation our two countries face questions of common concern and have quite a few points in common. We believe that Sino-U.S. relations will surely move forward steadily as desired by both our peoples so long as both sides made sincere efforts in conformity with the principles of the Shanghai Communique.

On September 7, 1977, however, Vice Premier Teng told the U.S. Associated Press delegation visiting China that discussions with Secretary Vance represented a retreat from proposals advanced by former President Ford. Teng claimed—no direct quotations permitted—President Ford had promised in 1975 that, if reelected, he would break diplomatic relations with Taiwan and establish them with Peking.

The fall 1977 China Export Commodity Fair at Canton saw about $60 million in business done by some 700 to 800 American businessmen. Over the past few years this semiannual event has been the scene of numerous transactions between Americans and the Chinese foreign trade corporations with business averaging $50 to $60 million each spring and fall.

The fall of 1977 also saw an increase in tourism in China as Peking decided to permit an increase in the number of visitors, probably in response to a need for greater hard currency earnings. The first Pan American World Airways tour of 120 people visited the PRC in December. PanAm and the United State-China Peoples Friendship Association will both send increased numbers of Americans to China in 1978.

Shipments of American agricultural products resumed in the fall of 1977 after nearly a 2-year hiatus. By the year's end about $60 million in cotton, soybeans, and soybean oil had left U.S. ports. Another $80 million in American cotton will be exported to China in the first half of 1978. New wheat contracts totaled $300 million.

In December 1977, the Work Gloves Manufacturers Association (WGMA) filed with the International Trade Commission (ITC) a petition pursuant to section 406 of the Trade Act of 1974 claiming that the import of Chinese work gloves was disrupting the U.S. market. This was the first market disruption complaint ever to be filed under section 406 of the act. The petition was filed December 15, 1977, and hearings were on February 7–8, 1978. On March 7 the ITC voted that imports of cotton gloves from the PRC were not disrupting the U.S. market.

The resumption of agricultural purchases by China in 1977 pushed U.S. exports to a level 27 percent over 1976; imports from China remained the same as in 1976. The prospects for 1978 clearly appear better still with known export contracts permitting an estimate of about $700 million, an increase of 4 times. China's modernization efforts and the stated intention of the Chinese to import foreign plant, equipment, and technology augur well for further increases.

Prospects appear particularly good for U.S. exports of petroleum exploration, drilling, and production equipment, including offshore, and for petroleum refining and petrochemical plant technology. Other areas of good potential include aluminum, iron and steel scrap, pulp and paper, chemicals, fertilizer, mining and construction equipment, machine tools, electronics items generally, including computers and telecommunications gear, and scientific instrumentation.

C. CHINESE FOREIGN TRADE POLICY

Since the establishment of the People's Republic in 1949, China has pursued a policy of total state control over all instrumentalities of foreign trade. As Mao Tse-tung said on the eve of the revolution:

> The restoration and development of the national economy of the People's Republic would be impossible without a policy of controlling foreign trade.

Pursuant to this policy, Peking established state-owned foreign trade corporations and adopted a series of measures to handle the import and export of various commodities, the issuance of import and export permits, the settlement of tariffs, the prohibition of smuggling, control over foreign exchange, and the inspection and testing of imports and exports. In 1958, the decision was made to enforce unified standards in dealing with the outside world in foreign trade.

Central Themes

Two central themes run consistently through the foreign trade policy of China. These are "self-reliance" and "trade on the basis of equality and mutual benefit." In self-reliance, Peking preserves independence by reducing reliance on foreign assistance and by limiting the foreign presence in China. As the Minister of Foreign Trade, Li Chiang, recently said:

> We must forever adhere to the policy of maintaining independence, keeping the initiative in our own hands and achieving regeneration through self-reliance. This is beyond doubt.

In equality of trade, Peking sees a way to supplement China's own resources without risk of entanglement while creating a useful channel for promoting understanding of China's socialism and other diplomatic objectives. Several years ago, Li Chiang wrote:

> China has opened up trade with other countries in a planned way, on the basis of equality and mutual benefit, to learn from other countries merits and to obtain necessary materials, equipment, and technology through exchange. This is putting into practice the principle of making foreign things serve China, and combining learning with inventing in order to increase her ability to build socialism independently, with her own initiative and relying on herself to speed up socialist construction.

On the basis of these policies, China is now trading with over 150 countries and has entered into trade agreements with more than 50 countries.

Foreign Trade and the Modernization Program

China is now embarked on a massive program to modernize agriculture, industry, science and technology, and national defense in a way designed to propel the PRC into the front ranks of the industrialized nations of the world by the turn of the century. To achieve these goals, substantial quantities of complete plants and related technology will have to be imported. But in the past these types of imports have caused ideological problems for the Peking leadership.

There have been swings in foreign trade policy toward more sharply restricted imports. After the Russian experience of the 1950's, which exposed the PRC to the danger of putting all of their reliance on a single source of supply, Peking turned to non-Communist trading partners. The modest program of the mid-1960's of importing complete plants from Japan and Western Europe was brought to a halt by the onset of the Cultural Revolution. Almost no foreign plants were imported between 1966 and 1971 while the ideological struggle over import policy was waged. But by 1973 it was safe for one leading trade official to link technological imports with self-reliance when he said:

> China imports some new equipment and technology that are needed in carrying out the policy of being more self-reliant and speeding up the building of socialism.

The reality of that policy is seen in the purchase by China during the period 1972–75 of some $2.7 billion in complete plant and associated technology.

After that period, policy shifted again and brought a virtual halt to the import of complete plants which lasted until the arrest of the Gang of Four in October 1976. Since their ouster, the Hua Kuo-feng leadership has stressed the importance of foreign trade in the growth of Chinese economic development. Retrenchment of the economy during 1977 prevented as quick a return to large scale plant and technology imports as had been expected in the West. Contracts will be negotiated in 1978, but most new plants will not contribute to the modernization program until after 1980. The pace of such purchases will depend on China's ability to expand exports, especially oil, and on China's need for foreign agricultural products. Peking's willingness to increase the use of credit will also affect the pace.

Financial Policy

China pursues a very conservative international financial policy. Generally, the PRC finances imports with export earnings, attempting to achieve a balance of trade on a multilateral basis. The balance of payments has been favorable in most years with export earnings, overseas remittances, and receipts of foreign debts more than compensating foreign aid expenditures, and debt repayments. The PRC has avoided long-term credit since liquidating its debt with the Soviet Union in 1965. For the purchase of grain, steel products, fertilizer, and complete plants, China has availed itself of short-term credits and deferred payments (medium-term credit).

When a combination of greater grain requirements and inflated Western prices caused a negative trade balance of about $800 million in 1974, Peking took steps to curtail imports. This reduced the deficit to only $200 million in 1975. The rather large surplus of $1.2 billion in 1976 was probably the result of a combination of factors, some continued restrictions on imports and political turmoil over the proper degree of dependence on foreign plant and technology.

Another favorable trade balance, about $1 billion, was run in 1977, but the outlook for 1978–80 is uncertain. With the need to enter into a new round of complete plant purchases in support of the modernization program, Peking will be weighing the risk of taking on additional foreign credits against a longstanding policy of self-reliance. The PRC will continue to use and in fact will probably increase the use of deferred payments. They may try to induce foreign banks to expand deposits in the Bank of China. Whether the PRC would opt for major lines of credit with Western banks and government lending institutions appears doubtful now, but this policy could shift under the press of the modernization program.

Policy Toward the United States

Politics and economics are inextricably interwoven in the fabric of PRC foreign trade relations. As Li Chiang writes:

> In order to adhere to the principle of equality and mutual benefit in foreign trade work, extensive consideration of politics and economics is necessary. They are not to be considered separately. First, we should put politics in command and resolutely implement our foreign policy.

The result of this policy, in the absence of fully normalized relations, is a Sino-American trade that has not reached its potential.

While China buys principally on the basis of price, quality, and terms, the injection of politics is visible in lost trade opportunities. Some say this Chinese policy places the United States in the position of being a residual supplier, and claim that China will buy from us only if a particular commodity (wheat, for example) is not available elsewhere. With the reopening of relations, the PRC placed large orders for American wheat, but when the relationship did not fully normalize, new orders were not forthcoming. Other factors enter the picture in the case of wheat, however. There were problems with the early U.S. wheat shipments; the Chinese have earlier long-term wheat agreements with Canada and Australia; and, even today, American wheat exporters are hesitant to accept orders owing to the risk raised by Chinese insistence on final inspection of the cargo at the PRC port of destination.

While the United States may not actually be a residual supplier of wheat, it does appear that in other instances a decision has been made to place orders elsewhere for political reasons. Trade continues with the United States because it is a political policy decision to do so, but economic policy also enters into the decision. The United States has become a stable $200 million annual market for Chinese products and in some cases we have products and technology that the Chinese regard as the best available.

D. UNITED STATES-PEOPLE'S REPUBLIC OF CHINA TRADE

Aggregate Levels

Since the peak years of 1973 and 1974, Sino-United States trade had settled into an annual two-way trade level of around $400 million. The downturn in U.S. agricultural exports to China in 1975, 1976, and the early part of 1977 brought U.S. exports down to modest levels of $200 to $300 million. Chinese exports to the United States since 1972 have, on the other hand, continued a gradual but steady increase. Table 2 demonstrates this increase, and forecasts $300 million in U.S. imports from China in 1978.

At this level of commercial interaction, the PRC continues to be a relatively insignificant trading partner for the United States in terms of total U.S. imports and exports. Since 1975, U.S. exports to the PRC have constituted one-tenth of 1 percent of all U.S. exports, while imports from China have totaled two-tenths of 1 percent of all U.S. imports. The United States share of PRC trade has also been small, coming to only some 2.5 percent of China's exports and imports in 1977. (See table 2.)

TABLE 1.—UNITED STATES-CHINA TRADE, 1900–53[1]

[In millions of U.S. dollars]

Year	U.S. exports	U.S. imports	Total
1900	$15	$27	$42
1901	10	18	28
1902	25	21	46
1903	19	27	46
1904	13	29	42
1905	53	28	81
1906	44	29	73
1907	26	33	59
1908	22	26	48
1909	19	29	43
1910	16	30	46
1911	19	34	53
1912	24	30	54
1913	21	39	60
1914	25	39	64
1915	16	40	56
1916	32	80	112
1917	40	125	165
1918	53	111	164
1919	106	154	260
1920	146	193	339
1921	108	101	209
1922	100	135	235
1923	109	188	297
1924	109	118	227
1925	94	169	263
1926	110	143	253
1927	83	152	235
1928	138	140	278
1929	124	166	290
1930	90	101	191
1931	98	67	165
1932	56	26	82
1933	52	38	90
1934	69	44	113
1935	38	64	102
1936	47	74	121
1937	50	104	154
1938	35	47	82
1939	56	62	118
1940	78	93	171
1941	95	87	182
1942	80	16	96
1943	53	12	65
1944	52	11	63
1945	108	6	114
1946	465	93	558
1947	353	117	470
1948	273	120	393
1949	83	107	190
1950	45	146	191
1951	0	46	46
1952	0	28	28
1953	0	1	1

[1] 1953–70 no trade. See table 2 for United States-China trade since 1970.

Source: U.S. Department of Commerce, Historical Statistics of the United States: Colonial Times to 1937, and Supplements, Washington: Government Printing Office, 1960.

TABLE 2.—UNITED STATES-PEOPLE'S REPUBLIC OF CHINA TRADE, 1970–78[1]

[In millions of U.S. dollars]

Year	Total trade	U.S. exports	U.S. imports	Imbalance
1970				
1971	[2] $5.0		$5.0	$−5.0
1972	95.9	$63.5	32.4	+31.1
1973	805.1	[3] 740.2	64.9	+675.3
1974	933.8	[4] 819.1	114.7	+704.4
1975	462.0	303.6	158.3	+145.3
1976	337.3	135.4	201.9	−66.5
1977	374.5	171.5	203.0	−31.5
1978 [5]	1,000.0	700.0	300.0	+400.0

[1] U.S. Department of Commerce, "Highlights of Exports and Imports," FT–990 series.
[2] Via 3d countries only.
[3] Including $50,600,000 shipped via 3d countries and not reported destined for the People's Republic of China.
[4] Including $11,700,000 shipped via 3d countries and not reported destined for the People's Republic of China.
[5] Estimate by the Bureau of East-West Trade, U.S. Department of Commerce.

TABLE 3.—UNITED STATES SHARE OF CHINESE TRADE, 1974–77

[In percent]

	1974	1975	1976	1977[1]
United States share of PRC imports[2]	11.0	4.1	2.2	2.5
United States share of PRC exports	1.7	2.2	2.7	2.5

[1] Preliminary estimate.
[2] These data are on a c.i.f. basis, Chinese port.

From ranking as China's No. 2 trading partner in 1973 and 1974, the United States has fallen to fifth place in 1975 and eighth place in 1976 and 1977. These percentages and rankings have varied primarily with the ups and downs of U.S. grain exports, and indicate the unsettled nature of United States-China trade in the past few years. Since 1972, total trade has not taken off in a straight line, exhibiting any predictable pattern. Except for 1977 when figures leveled off, Chinese exports to the United States have shown a gradual and steady increase. U.S. exports of manufactured goods have also gradually increased, although some ups and downs can be seen in the earlier complete plant sales and the lag year of 1976. U.S. agricultural sales, in contrast, have varied dramatically, causing two-way trade figures to move first sharply up and then sharply down.

China's buying plans, influenced by harvest yields, industrialization plans, internal political disruptions, earthquakes, hard currency shortages and other considerations, have shown a remarkable ability to change quickly. From a balance of trade deficit of —$800 million in 1974 (for total PRC trade), the PRC reduced imports and expanded exports to the point of achieving over $1 billion trade surpluses in 1976 and 1977. The United States-China trade position mirrored this change, going from U.S. surpluses of $675 million in 1973 and $704 million in 1974 to U.S. deficits of $67 million in 1976 and $32 million in 1977.

Composition of Trade

The aggregate figures are misleading, however, in that they minimize the relative importance of some of the actual commodities traded. As mentioned above, Chinese exports of textiles and cotton work gloves led to complaints of disruption of the U.S. market. Although neither complaint resulted in an actual imposition of U.S. quotas, the Chinese appear sensitive to this problem and may have reduced exports of both commodities. U.S. imports of crude feathers from China constitute roughly one-third of all feathers imported ($19 million imported from China in 1977); imports of Chinese fireworks are one-half of total imports ($10 million imported from China in 1977). Table 5 demonstrates other Chinese goods that have become important in the U.S. market.

Similarly, certain U.S. exports play a growing role in China's economy and her plans for modernization of various industrial sectors. Table 4 lists the 25 leading U.S. exports to the PRC in 1977, with the previous values of 1976. It can be seen that while some items are regular exports, many are one-shot deals, bought for a specific project or purpose.

TABLE 4.—25 LEADING UNITED STATES EXPORTS TO THE PEOPLE'S REPUBLIC OF CHINA, 1976–77

[In thousands of U.S. dollars]

5 digit SITC commodity group	1976 value	1977 value
1. Special purpose vehicles (73240)	0	28, 847. 9
2. Soybean oil (42120)	0	28, 297. 3
3. Synthetic fibers (26621)	7, 482. 7	18, 967. 3
4. Raw cotton (26310)	0	17, 519. 0
5. Soybeans (22140)	0	14, 385. 8
6. Nitrogenous fertilizer (56110)	0	8, 076. 0
7. Internal combustion engines (71150)	1, 330. 3	5, 695. 7
8. Aluminum (68410)	25, 641. 3	5, 311. 3
9. Organic chemicals (51200)	2, 957. 5	4, 875. 7
10. Fats, tallow (41132)	0	3, 689. 8
11. Machine tools (71510)	2, 096. 7	3, 506. 7
12. Kraft paper and paperboard (64130)	0	3, 397. 4
13. Parts for instruments and apparatus (86199)	682. 2	3, 008. 5
14. Other inorganic chemicals (51400)	1, 530. 9	2, 455. 2
15. Other chemical products and preparations (59999)	3, 741. 1	1, 949. 6
16. Taps, cocks, valves (71932)	4, 202. 8	1, 789. 7
17. Statistical machines (calculating from punched cards or tape) (71430)	265. 3	1, 687. 0
18. Other electrical measuring and controlling instruments (72952)	941. 2	1, 466. 4
19. Excavating, leveling, boring machinery (71842)	2, 303. 2	1, 436. 0
20. Sulphite wood pulp (25182)	1, 302. 1	1, 294. 2
21. Plastic materials (58120)	1, 403. 2	1, 261. 2
22. Pumps for gases, etc. (71922)	9, 762. 1	913. 3
23. Tools for hand or machine use (69524)	4. 0	866. 8
24. Parts for motor vehicles (73289)	344. 8	688. 8
25. Lifting and loading machinery (71931)	3, 517. 1	664. 2

TABLE 5.—25 LEADING UNITED STATES IMPORTS FROM THE PEOPLE'S REPUBLIC OF CHINA, 1976–77

[In thousands of U.S. dollars]

5-digit SITC commodity group	1976 value	1977 value
1. Feathers (29196)	14, 256. 5	19, 001. 2
2. Cotton fabrics (65210)	32, 560. 0	17, 314. 8
3. Basketwork (89922)	10, 095. 7	10, 728. 3
4. Fireworks (57130)	6, 565. 3	10, 000. 5
5. Bristles (29192)	8, 063. 7	8, 711. 5
6. Antiques (89605)	9, 929. 9	8, 128. 2
7. Carpets (65750)	4, 252. 2	7, 254. 3
8. Men's and boys' outer garments (84111)	1, 998. 8	6, 392. 8
9. Essential oils and resinoids (55110)	3, 695. 0	5, 479. 4
10. Tea (07410)	2, 874. 2	5, 185. 5
11. Nuts (05171)	3, 372. 5	5, 033. 9
12. Women's girls' and infants' outer garments (84112)	3, 468. 8	4, 692. 3
13. Linens (65691)	3, 449. 5	4, 587. 0
14. Tin (68710)	13, 195. 3	4, 345. 3
15. Tungsten (28392)	2, 288. 8	4, 255. 7
16. Men's and boys' under garments (84113)	3, 680. 4	4, 191. 6
17. Fine animal hair (26230)	3, 178. 0	4, 050. 5
18. Outer garments, knitted or crocheted (84144)	1, 599. 0	3, 389. 0
19. Footwear (85102)	3, 243. 5	3, 332. 1
20. Prepared feathers and down and articles threrof (89992)	673. 5	2, 586. 0
21. Cinnamon (07522)	2, 058. 6	2, 416. 1
22. Porcelain (66640)	1, 543. 0	2, 411. 9
23. Raw silk (26130)	3, 947. 7	2, 342. 8
24. Gloves, mittens, stockings and socks (84126)	2, 021. 6	2, 316. 2
25. Mats, matting, screens, etc. (65780)	1, 917. 9	2, 309. 9

Three of the top five exports to China in 1977 were agricultural goods. The resumption of agricultural sales, in the fall of 1977 was long awaited after the 2-year hiatus following China's substantial purchases in 1973 and 1974. To date sales have included only soybeans, soybean oil and cotton. Sales of wheat, which held between one-quarter to one-half of total U.S. exports to China in 1973 and 1974, only reappeared in 1978.

Cotton sales in the last 2 months of 1977 totaled $28.8 million, and contracts for the first part of 1978 are expected to total some $65 million. Twenty-eight million dollars' worth of soybean oil, and $14 million of soybeans were shipped in 1977. Although the soybean figure is down considerably from $138 million in 1974, China's purchases of these commodities may signal a change in policy that will tend toward further U.S. agricultural sales.

Major U.S. Sales

Between 1972 and 1975, China made large purchases of complete plants, major segments of plants, and associated equipment and technology from the United States, Japan, and European countries. Major U.S. transactions included the Boeing jet sales and M. W. Kellogg fertilizer plants, believed at the time to be harbingers of future massive sales to China. Further large sales did not materialize, however, as China retrenched to absorb the new equipment and technology and to conserve hard currency. While it is believed that China will embark on a new round of major plant purchases in the near future, U.S. sales in the interim period have not been spectacular. The largest have remained in the $10 million to $20 million range.

The most successful area of U.S. sales to China over the past few years has been in petroleum exploration, drilling, and production equipment as well as petroleum pipelines. U.S. sales in this area have totaled approximately $125 million in the period 1972–77, with additional contracts worth $60 million for delivery in 1978. Companies involved have included Dresser Industries, the National Supply Division of Armco Steel Co., Baker Tool Co. and Caterpillar Tractor, in addition to a number of others with smaller sales.

In addition to this equipment, sales of technology for petroleum refining and petrochemical plant processes have totaled over $100 million for the period through 1977. This area promises to remain one of the more flourishing in Sino-United States trade.

Transhipment of goods through foreign ports (often Hong Kong or Kobe, sometimes France) has been a problem in the analysis of volumes and types of goods being sent to and from the United States and China. The goods show up as an export from the intermediary and are not recorded in U.S. statistics, thereby undercounting trade in both directions. A case in point is the export of polyester staple to China--an item of some commercial significance. Contracts worth $35 million were signed in 1977, of which 29 million dollars' worth was exported (6 million dollars' worth was slipped to 1978). Only 18 million dollars' worth was declared for delivery to the PRC in U.S. statistics, however.

Another example of transhipment is in the area of computer sales. The largest computer sale to date saw two seismic CDC Cyber–172's for $5.5 million shipped to China via France. This export was recorded from the United States to France only and not the United States to China.

Although not as visible as products mentioned above, sales of machine tools have formed an important part of U.S. exports to China. As a result of two Chinese buying missions to the United States and a number of contracts signed by Techimport in Washington, D.C., sales to date have come to over $30 million. With the advent of a clearly enunciated policy in China of mechanization and modernization of agriculture, and particularly the "standarization, serialization, and specialization" of machinery, there is a good potential for further U.S. export of high-precision, specialized machine tools.

Two commodities of demonstrated importance to the Chinese, but of variable export potential have been aluminum and nitrogenous fertilizer. Alumunim sales totaled $46 million in 1975, $26 million in 1976, and $5 million in 1977. Fertilizer sales came to $8 million in 1977, up from zero in 1976.

A promising indication of growing diversification in Chinese purchases from the United States can be seen in the recent U.S. sale (by Valmont Industries) of irrigation equipment for use on a state farm in northeast China. Deere and Co. has also sold 40 to 50 pieces of major equipment including a fleet of tractors to this farm, a pilot project designed to test the feasibility of rapid mechanization.

Canton Fair

The semiannual Chinese Export Commodities Fair continues to be held every year in Canton from April 15 to May 15, and October 15 to November 15. Predictions of its gradual demise a few years ago have not proved to be true—it continues to attract some 26,000 foreigners every spring and fall, who transact an estimated 40 percent of China's total export trade.

U.S. attendance at the fair has increased to around 700 to 800 businessmen, representing some 400 companies. In recent years, about two-thirds of business transacted has been in U.S. import contracts and one-third in U.S. export contracts. U.S. attendees at the 1977 fall fair negotiated some $40 million in U.S. imports and $20 million in U.S. exports; 1976 spring and fall fairs each concluded around the same amount of Sino-United States business.

E. Developments in Commercial Practice

Introduction

Although 7 years of trade between the United States and the People's Republic of China have begun to demystify trading procedures and standardize U.S. approaches to the China market, actual commercial practices have changed very little. The American business community has become accustomed to the major aspects of handling trade with the People's Republic of China: Dealing with state-owned foreign trade corporations and making the initial trip to the Canton Fair. The Chinese, on the other hand, have rapidly learned capitalist ways of making money, and many transactions reflect this expertise. But substantial differences in business practice remain. The relatively new importance of foreign trade in the Chinese economy, and the fine tuning necessary to mesh the trade needs of a state-controlled economy with the trading imperatives of a capitalist economy have not yet permitted an easy trading relationship between the United States and China. Developments in commercial practice and continuing attempts to facilitate the mechanisms of trade remain subjects of importance.

Various ways of dealing with United States and Chinese systemic differences in approach to business transactions have evolved over the years. Americans and Chinese have gradually shown a willingness to accommodate unfamiliar business practices and to modify their own in order to make trade possible.

Sino-American commercial relations are reviewed here in four central areas: Selling to China, buying from China, developments in commercial practices, and developments in financial practices.[2]

Chinese Business Practices

U.S. businessmen with recent experience in China trade and Europeans with a longer relationship agree that certain characteristics of the Chinese way of doing business warrant special attention:

> In deciding which purchases to make the Chinese are as practical as most other businessmen. Li Chiang, Minister of Foreign Trade, has recently confirmed that the three principal criteria in buying are price, quality, and terms of delivery.
>
> The Chinese have a strict constructionist attitude about contracts. Contracts are binding and must be honored, down to the last letter. Canceling a contract with the Chinese is likely to reduce chances of any future trading relationship for the U.S. company. Provisions written into the contract will be carried out; anything not in the contract will not be carried out. This means that the U.S. businessman must be extremely careful to write every detail into the contract—even particulars that may be superfluous in other parts of the world.
>
> The Chinese place great importance on getting to know the people with whom they might be doing business. Establishing a congenial and "mutually beneficial" relationship is more highly considered by the Chinese than by many other U.S. trading partners in the world.
>
> The PRC has an impeccable payment record. In terms of receiving payment, exporting to China appears to involve little risk. This is important when the exporter realizes that, contrary to common international practice, Chinese import contracts call for a short period of time in which the seller is left without goods, documents, or payment.
>
> Doing business in the PRC is different. It takes greater study, a greater investment in executive talent, and above all, great patience. The market is harder to penetrate, and once in, it may tie up capital for a longer period of time. Contractual discussions are carried on with Chinese who are superb negotiators and experienced businessmen. In short, it should not be undertaken without prior study and consideration.

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[2] For more detail see OBR 76–43, "Doing Business With China" and OBR 74–64 "Financial Practices in U.S.-China Trade," available from the U.S. Department of Commerce. Both reports will be updated in 1979.

Selling to China

Finding the market in China, and making that market aware of a U.S. company's goods and services has remained a problem for U.S. businessmen. The typical procedure continues to be to mail pertinent information—including unsolicited proposals, brochures, and annual reports—to the head office of the proper foreign trade corporation in Peking, and then to wait. If an invitation to come to China is forthcoming, technical and then commercial discussions may proceed. If not, the next step is generally to proffer more information.

In the past year or two, a more direct line of action has been supplementing the above scenario. Many companies are marketing their qualifications, products, and know-how in China in the form of a packaged technical seminar. Presentation of a seminar, usually in Peking, still requires an invitation from the Chinese, and is generally initiated, planned, and financed by the U.S. company. Companies proposing seminars correspond first with the appropriate foreign trade corporation, in addition to the CCPIT—China Council for the Promotion of International Trade—and for more scientifically oriented seminars with the Scientific and Technical Association of the People's Republic of China. Submitting a seminar proposal does not automatically elicit an invitation, but it may be more likely to receive favorable attention than a straight sales pitch.

Although relatively new to American firms, presentation of a technical seminar in China can be a route to signed contracts. It is estimated that some 300 technical seminars were put on in China in 1977, of which around 30 were American. Negotiations and contracts have some times resulted, but even when they have not, companies have established a long-term working relationship with the Chinese under which future sales can take place. The first known seminars by U.S. firms in China started in 1973 and their increasing frequency points to an alternatively viable way of presenting American goods and know-how to the foreign trade corporations in Peking.

Access to end-users and direct selling to the person who will be using the exported U.S. products remains difficult in China. Companies who enjoy an ongoing commercial relationship, however, have come to recognize that end-users often do participate in negotiations in Peking along with the staff of the trade corporations. The primary approach of a U.S. company, however, should continue to be through the formal foreign trade structure. Advertising in the PRC still takes the form of direct correspondence with the trade corporation which then distributes copies of mailed information and promotional material to end-users and others who evaluate proposals. It is possible, however, to advertise in certain journals such as the American Industrial Report and the American Petroleum Production and Processing Report which are seen in China by plant management.

Buying From China

While some U.S. companies have found it difficult to export to the Chinese, the Chinese on the other hand have had problems in understanding the U.S. market. Increased attention to marketing techniques and greater flexibility in meeting U.S. market demands have characterized Chinese commercial practices in exporting over the last several years. Chinese willingness to comply with designs and specifications for textile goods, willingness to comply with U.S. Food and Drug Administration (FDA) regulations for foodstuffs, and various other accommodations emphasize their desire to earn hard currency through exports. In contrast to the earlier years in United States-China trade, the Chinese now file registration and processing forms for low-acid canned foodstuffs with the FDA. They allow U.S. company labels to be sewn on Chinese garments alongside the Chinese label. They provide for CCIB—China Commodities Inspection Bureau—inspection during and after production of apparel being shipped to the United States and in some cases allow U.S. buyer's visitation to factories. They appear increasingly sensitive to U.S. importer complaints of inadequate notification of short-supply, and have made conscientious attempts to maintain a steady supply for "old friends."

Moving beyond the stage of being an exporter primarily of raw materials, semiprocessed goods, and consumer items, the Chinese have hopes of marketing certain machine tools in the United States. Another attempt to expand the scope of China's exports can be seen in the increasing numbers of "minifairs" put on in China over the last several years. The use of minifairs specializing in one group of commodities began to expand in early 1975. Since that time, around 10 have been held every year, in which U.S. companies have participated, and reports indicate an increasing refinement of presentation and awareness of U.S. market demands. Fairs are generally held for 2 to 3 weeks in the cities of Peking, Shanghai, Kwangchow, and Tientsin and concentrate on such commodities as carpets, feathers and down, fur and leather garments, and arts and crafts. China's semiannual export commodity fair held in Kwangchow (Canton) remains the principal attraction for foreign buyers.

Emphasizing the importance China places on export of arts and crafts, a new foreign trade corporation was established on January 1, 1978, called the China National Arts and Crafts Import and Export Corporation. The corporation takes over many products formerly handled by the Light Industrials Corporation, including pottery and porcelain, handicrafts and straw products, jewelry, ivory carvings, and cloisonne wares. Its address and those of the other foreign trade corporations, along with several other pertinent addresses, may be found in the appendix.

Developments in Contractual Practices

While both Chinese and American negotiators have become more flexible over the past several years in understanding and attempting to comply with unfamiliar contractual practices, the basic format of the Chinese standard contract has remained the same. U.S. businessmen are becoming more aware of Chinese business practices and may be less legalistic in their approach to commercial transactions. On the other hand, the Chinese have made some slight modifications in contract language. In general, however, Chinese standard contracts between foreign trade corporations and United States and other foreign businessmen are substantially as they were when trade resumed in 1972.

The Chinese contractual clause regarding arbitration is the most conspicuous case in point. The Chinese prefer to settle commercial disagreements by conciliation, and although some Sino-United States contracts now provide for arbitration proceedings in a third country, usually Sweden, Switzerland, or Canada, there is to date no known U.S. case of a dispute actually being carried to arbitration. Intensive conciliation discussions have occurred in several instances and have been resolved short of arbitration. The American Arbitration Association and others have attempted to pursuade the Chinese to employ a "model" arbitration clause calling for the application of the procedural rules of the U.N. Economic Commission for Europe, but the Chinese have as yet been unwilling to comply.

Similarly, force majeure clauses in standard contracts are generally accepted verbatim by the U.S. importer and exporter, although the clauses continue to provide more latitude of interpretation for Chinese exporters than for U.S. exporters. The prevailing attitude of U.S. firms continues to be that attempts to negotiate changes in the clause are more trouble than they are worth, since the end result of any dispute and claims ("working out what is least bad for both parties") will generally be the same.

Inspection and claims is another area in which U.S. firms generally have had to acquiesce to the Chinese way of doing things. The China Commodities Inspection Bureau (CCIB), a bureau directly under the Ministry of Foreign Trade in the PRC trade structure, continues to perform final inspection of all import and export goods on behalf of the Chinese foreign trade corporations. Chinese contractual language reflects this final right of inspection, and it remains an irritating hindrance in United States-China trade. This is particularly true in wheat trade, where most U.S. exporters would not be willing to sell to China because of final inspection at the PRC port of destination.

One notable change that has come about in the past few years has been the Chinese switch from selling on a purely CIF basis to allowing foreign importers to handle their own insurance. In insuring foreign trade, the official policy now reads, "The People's Insurance Company of China holds that transport insurance on imports and exports should be arranged by the cargo owners, so China's imports are generally insured with the People's Insurance Company of China, whereas insurance on China's exports is generally arranged by the foreign importers." China will sell certain commodities (such as oil and coal) f.o.b., and continues to buy almost solely on an f.o.b. (stowed) basis, handling all the ocean freight charges itself.

Negotiation of major plant sales to China, with provisions for onsite personnel and training involve complexities requiring detailed contracts. Addenda describing specific provisions and responsibilities of each party are sometimes more explicit than would be necessary in commercial transactions in other parts of the world, but U.S. companies have learned the necessity of being complete in their contractual dealing with the Chinese.

Developments in Financial Practices

A number of changes over the past several years have characterized China's financial dealings with the West. Although much speculation has circulated regarding substantial modification of China's conservative financial practices, as of this writing PRC policy remains the same. Certain mechanisms for payment, and banking relationships have been altered.

All commercial transactions of the PRC with foreign countries must still be settled through the Bank of China (BOC), the foreign exchange arm of the People's Bank of China. No foreign banks are allowed to establish branches within the PRC, but a number of foreign banks enjoy full coorespondent relationships with the BOC and manage commercial transactions much as they would with any bank.[3] As of early 1978, no U.S. bank had yet established full correspondent banking relations with China, although four have arranged limited correspondent relationships, essentially limited to the handling of remittances, and one has established an expanded correspondent relationship. The latter, the First National Bank of Chicago, announced on January 26, 1978, that its new relationship now permits it to handle commercial letters of credit, payments, collections, and foreign exchange transactions for customers. First National has announced that it would structure all transactions in a way to insulate them from foreign claims/frozen assets ligitation potential.

Payment for commercial transactions between the PRC and the United States continues to be primarily in the form of letters of credit, although some U.S. importers have been allowed documents against payment terms, thereby saving them the cost of letters of credit financing. There has been no change in the Chinese practice of using unconfirmed, irrevocable, and nontransferrable letters of credit, nor have the Chinese ceased to insist on U.S. letters of credit that are confirmed, irrevocable and usually transferrable. Moreover, it is still the case that authorization of payment to a U.S. exporter is made only after the proper shipping documents are received by a branch of the BOC in China.

Chinese import contracts are generally denominated and paid in Western currencies. Chinese export contracts are denominated either in U.S. dollars or in RMB (Ren Min Bi—the "People's Currency"). The Chinese had displayed a preference for denominating in RMB, but in the last 2 years they have been quite flexible about accepting U.S. dollar-denominated contracts. The degree of flexibility varies by product and trade corporation and may also be related to the variability of the RMB-U.S. dollar exchange rate. In early 1972 the Chinese began quoting U.S. dollar-RMB exchange rates for purposes of commercial transactions, in addition to rates for various other currencies. In August of 1972, separate buying and selling rates began to be quoted. Buying RMB forward against the U.S. dollar was not possible until 1975. Although there has been little use made of this facility by importers to date, greater exchange rate fluctuations in the future may make it worth the cost. Rates for "Forward RMB cover" at the end of 1977 ranged from 0.9 percent for 1 month to 4 percent for 6 months.

The area of greatest speculation and uncertainty about China's future financial policy concerns PRC acceptance of credit and accumulation of external debt. Althouth the PRC has run trade surpluses of around $1 billion for the last 2 years, the country ran substantial deficits during the 1973–75 period of importation of complete plants. Some observers calculate that an aggressive plan for industrial modernization and economic development will not be possible without substantial borrowing from abroad. While the Chinese have been educating themselves on the structure of international banking and world financial markets they have not yet begun accepting conventional loans and continue to claim they will not do so. Financing of major foreign exports to China continues to be done by deferred payments or "supplier's credits," usually for terms not exceeding 5 to 7 years and at interest rates of not less than 7 percent. This form of credit is not considered "debt" by the Chinese. With the possible exception of short-term credits for agricultural products most purchases of American commodities have been for cash. The bulk of Chinese exports to the United States continue to be paid for in cash.

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[3] Actually, two British Banks have had branches in Shanghai since 1949, but the amount of business they are permitted to transact is extremely small.

Appendix 1. Chronology of Commercially Related Events

December 17, 1950—Department of Commerce embargoed all exports to China under authority of the Export Control Act of 1949. Under the Defense Production Act of 1950, Commerce issued Transportation Orders T–1 and T–2, which prohibited U.S. carriers from calling at the PRC and prohibited all U.S.-Flag air or sea carriers from transporting or loading any cargo ultimately destined for the PRC. Bunkering of vessels calling or having called at Chinese ports was also prohibited. In a complementary action, the Treasury Department under the Trading With the Enemy Act of 1917 issued the Foreign Assets Control Regulations.

December 29, 1950—PRC assumes control over all U.S. property in China.

1951—Seven types of Chinese furskins prohibited entry by the Trade Agreements Extension Act of 1951.

July 21, 1969—American tourists permitted to purchase up to $100 of goods originating in the PRC. Passports automatically validated for travel to China for Members of Congress, journalists, professional teachers, scholars with postgraduate degrees and students in colleges and universities, scientists and medical doctors, and American Red Cross representatives.

December 9, 1969—Foreign affiliates and subsidiaries of American firms permitted to trade in non-strategic goods with China. $100 limit on purchase of Chinese goods for non-commercial use removed and "accompanied baggage" requirement dropped.

March 16, 1970—Validation of U.S. passports for China for any legitimate reason.

April 1970—Shipment to China authorized for non-strategic, foreign-manufactured goods containing American components.

August 1970—Bunkering of third country ships carrying non-strategic goods to the PRC permitted providing bunkers were of non-U.S. origin.

March 15, 1971—Removal of all restrictions on travel by Americans to China.

April 7, 1971—Peking invited the American table tennis team to China.

April 14, 1971—President Nixon announced his intention of relaxing the 21-year old embargo.

May 7, 1971—Treasury removed controls on the use of dollars in transactions with the PRC. Prohibition against American-controlled foreign flag vessels calling at PRC ports removed. U.S. oil companies abroad authorized to bunker vessels controlled by the PRC except those going to or from North Korea, North Vietnam, or Cuba. Commerce and Transportation modify T–2 to permit U.S. carriers to transport commodities authorized for export to China to non-PRC ports.

June 10, 1971—The first step in removal of the embargo is taken by placing a long list of commodities under a general license.

July 15, 1971—President Nixon announced plan to go to China prior to May 1972.

October 25, 1971—The PRC entered the United Nations.

February 14, 1972—The PRC placed in the same category as the Soviet Union and certain East European countries for export control purposes. Further modifications made in Treasury's Foreign Assets Control Regulations.

February 1972—Nixon visited China.

February 28, 1972—Shanghai Communique issued.

November 22, 1972—Transportation order T-2 further modified to permit U.S. air carriers and ships to visit the PRC.

February 1973—Secretary Kissinger visited Peking and both countries agreed to the establishment of liaison offices in the respective capitals.

May 30, 1973—The National Council created on March 22, 1973 with the encouragement of the Department of State and Commerce.

June 1, 1973—Both the U.S. Liasion Office in Peking and the PRC Liaison Office in Washington opened for business.

July 2, 1973—Short supply controls instituted over exports of iron and steel scrap of U.S. origin.

November 1973—First broadly based, commercially oriented American delegation to China in more than 20 years consisting of National Council Board members.

November 1974—Principles of the Shanghai Communique reaffirmed during visit to Peking by Secretary Kissinger.

December 31, 1974—U.S. short supply controls over steel scrap terminated.

January 3, 1975—Trade Act of 1974 enacted.

January 1975—Chinese Gas Turbine Delegation visited the United States.

January 1975—American Arbitration Delegation visited Peking.

February–March 1975—China National Textile Import and Export Corporation Delegation to the United States.

May 1975—Greater San Francisco Chamber of Commerce Delegation visited the PRC.

July–August 1975—First Electronic Industries Association (telecommunications) visit to China.

September 1975—First visit to the United States by the China Council for the Promotion of International Trade.

September–October 1975—Visit by the China National Light Industry Import and Export Corporation.

September–November 1975—China National Native Produce and Animal Byproduct Import and Export Corporation visit.

November 1975—First visit by the National Machine Tool Builders' Association to the PRC.

December 1975—President Ford's visit to China.

January–March 1976—China National Minerals and Metals Import and Export Corporation Delegation visit.

February–April 1976—China National Light Industry Import and Export Corporation (general merchandise) visit.

March–June 1976—Buyer's group from the China National Technical Import Corporation Delegation (machine tools).

April 1976—Visit by the Mid-America Committee to Peking.

April 1976—Los Angeles Chamber of Commerce group visited China.

September–October 1976—Visit of China National Light Industrial Import and Export Corporation (jewelry, handicrafts, and straw goods).

October 1976—Second visit by board members of the National Council for United States-China Trade.

November–December 1976—Visit to China by the U.S. Agricultural Chemicals group.

February 1977—President Carter reaffirms U.S. adherence to the Shanghai Communique.

March–April 1977—China National Native Produce and Animal Byproducts Import and Export delegation (essential oils) visited the United States.

March–May 1977—Visit by second China National Textile Import and Export Corporation.

April 1977—Visit to China by the National Council's Importers Steering Committee.

April 1977—State of Wisconsin Delegation visited the PRC.

May 1977—Visit by the State of Washington Delegation to China.

June 1977—The U.S. Food Processing and Packaging Delegation visited the PRC.

June–July 1977—Delegation from the China Petroleum and Natural Gas Exploration and Development Corporation visited the United States.

July 1977—Visit by Grain Cooperative Alliance Wheat Delegation to Peking.

July 1977—Second visit by a National Machine Tool Builder's Association Group to China.

July–August 1977—U.S. Mining Delegation to China.

August 1977—Second visit by the Electronic Industries Association to the PRC.

August 1977—Secretary of State Vance visited Peking.

September 1977—Visit by the second China Council for The Promotion of International Trade delegation.

October–November 1977—China National Packaging Corporation visit to the United States.

November–December 1977—First American Petroleum Equipment Delegation visited China.

December 1977—First Pan American Airways Tourist group to the PRC.

December 15, 1977—First market disruption petition filed under Section 406 of the Trade Act of 1974 against the PRC.

January 1978—Visit by the China Petroleum Corporation Delegation.

January–March 1978—Second China National Technical Import Corporation Buying Group (Machine Tools).

March 1978—International Trade Commission denies petition filed against PRC work gloves in December.

April 1978—Visit to China by U.S. Light Industry Group.

May 1978—U.S. Agricultural Machinery Delegation to the PRC.

May 1978—National Security Council chief, Brzezinski visited Peking.

APPENDIX 2. FOREIGN TRADE CORPORATIONS

China National Cereals, Oils and Foodstuffs Import and Export Corporation, 82 Tung An Men Street, Peking, People's Republic of China. Cable: Ceroilfood Peking. Telex: 22081 Cerof Cn Peking.

China National Chemicals Import and Export Corporation, Erh Li Kou, Hsi Chiao, Peking, People's Republic of China. Cable: Sinochem Peking. Telex: 22043 Chemicn Peking.

China National Light Industrial Products Import and Export Corporation, 82 Tung An Men Street, Peking, People's Republic of China. Cable: Industry Peking. Telex: 22082 Light Cn Peking.

China National Machinery Import and Export Corporation, Erh Li Kou, Hsi Chiao, Peking, People's Republic of China. Cable: Machimpex Peking. Telex: 22042 Cmtec Peking.

China National Metals and Minerals Import and Export Corporation, Erh Li Hsi Chiao, Peking, People's Republic of China. Cable: Minmetals Peking. Telex: 22041 Mimet Cn Peking.

China National Native Produce and Animal By-Products Import and Export Corporation, 82 Tung An Men Street, Peking, People's Republic of China. Cable: Chinatu Hsu Peking. Telex: 22083 Tuhsu Cn Peking.

China National Technical Import Corporation, Erh Li Hou, Hsi Chiao, Peking, People's Republic of China. Cable: Techimport Peking. Telex: 22044 Cntic Cn Peking.

China National Textiles Import and Export Corporation, 82 Tung An Men Street, Peking, People's Republic of China. Cable: Chinatex Peking. Telex: 22080 Cntex Cn Peking.

China National Arts and Crafts Import and Export Corporation, 82 Tung An Men Street, Peking, People's Republic of China. Cable: Art China Peking. Telex: 22155 Cnart Cn.

CONTRACTS, PRACTICE AND LAW IN TRADE WITH CHINA: SOME OBSERVATIONS

By Stanley Lubman[*]

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> "Erh li gou doesn't mean 'early go' "
>
> American businessman during trade negotiations in Peking, 1978.

Erh li gou ("two mile gully") is the street in Peking on which stands the "large import building", the headquarters of the Chinese state trade corporations which purchase machinery, equipment, chemicals and technology from abroad. The punning reference to the protracted length of negotiations there is relevant to this piece, because the writer spent seven weeks between mid-January and mid-April, 1978 participating in negotiations in Peking; the long stay provided an opportunity to test generalizations and to write with some immediacy.

This essay describes the process of negotiating sales of capital goods to the Chinese corporations and the contracts which embody such transactions, as seen by this writer in mid-1978.[1]

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[1] See also Law and Politics in China's Foreign Trade (Victor H. Li ed. 1977), which is particularly helpful in describing the experience of China's European and Japanese trading partners and in setting forth contract forms; Gene Hsiao. *The Foreign Trade of China: Policy Law, and Practice* (1977), a general overview; Dicks, *The People's Republic of China* in East-West Business Transactions 397 (R. Starr ed. 1974); Reghizzi, *Legal Aspects of Trade with China*, 9 Harv. Int'l L. J. 85 (1968): Smith, *Standard Form Contracts in the international Commercial Transactions of the People's Republic of China:* 21 Int'l and Comp. L. Quart. 133 (1972); J. Dingle, Technical Selling in China (1974); and Holtzmann, *Resolving Disputes in U.S.—China Trade* in Legal Aspects of U.S.-China Trade (H. Holtzmann, ed. 1975). The *Far Eastern Economic Review* and The Asian Edition of the *Wall Street Journal* are indispensable for following current developments.

Change in foreign trade policy was very much in the air in Peking while this was being written, and negotiations and contracts alike reflect new policies. This essay also notes some recent developments in a related area that may affect China's foreign trade practice. Some indications appeared in early 1978 that China's domestic legal institutions were being strengthened and developed.

China's formal legal system has in recent years been conspicuously unimportant in influencing the making and application of rules, within China as well as in China's foreign trade. At its very least, the new policy toward law is an interesting expression of an aspect of the Chinese leadership's development strategy, and noteworthy for that alone; beyond that, it may have other implications.

Lack of space prevents detailed discussion here, but some likely subjects of future speculation can be suggested. China now seems to be traveling developmental roads which other societies have discovered. although they began at different starting points. It is worth noting, for instance, that as the idea of "self-reliance" becomes modified not only are China's imports of goods and technology increasing, but China's Minister of Foreign Trade has recently expressed willingness to consider transactions which the Chinese have previously resisted, such as manufacturing exports to buyers' specifications, incorporating components supplied by foreign buyers, and reviving barter. The next stage, already the subject of speculation in the West, may see assembly operations and more complicated transactions such as coproduction and product buyback arrangements. Hong Kong at the moment promises to be the focus of interesting experiments in Sino-Western trade and industrial cooperation.

At the very least, it is probably no coincidence that new interest in a variety of types of international transactions has been articulated contemporaneously with new emphasis on the domestic legal system. Without any specific connection between the two trends it is possible to note that they share an underlying receptiveness to the use of orderly and structured institutions for economic development operating according to increasingly regularized rules. Other policies announced in early 1978 reinforce this impression, particularly the intense emphasis on improving China's scientific and technological base and on improving the quality of education. Common to these policies and to the new emphasis on law is a willingness to entrust more responsibility to decision-makers because of their "expertness" rather than their "redness".

Beyond this confluence of trends lie further possible implications for increased regularization of Chinese society. Perhaps the time has come for the accretion of bureaucratic practice to be expressed in regulations and codes less tentative than much Chinese legislation in the past. Although it remains highly unlikely that the Western legal tradition, which had never taken hold in China before 1949, will exert a discernibly strong influence, pragmatism and the need to develop solutions to the problems of managing an increasingly more complex economy may impel Chinese planners to choose selectively from analogies derived from the experience of other nations, developed as well as developing.

It is too early to be confident that a lasting commitment has been made to fashioning and using institutions for implementing policies that reduce the use of mass mobilization and increase the making and application of rules by officials charged with those tasks. Even if policy could change again, though, the present mood and current experimentation reflect an openness and flexibility that are striking by contrast to the policies that dominated the previous decade.

The pages that follow describe a mix of institutions and practices at a point in time that may be misleadingly fixed: Just as a river may be composed of currents moving at different speeds, the Chinese institutions discussed below, artificially captured in print, are changing unevenly, some hardly at all. The foreigner's point of view, like a watcher from the river bank, is limited. But because the institutions of foreign trade are those with which the foreigner can have the most sustained contact, insight into the operation of those institutions may furnish hints of less immediately visible developments.

I. Negotiations in Peking

A. The Road to Peking

Since the purge of the "Gang of Four" in October, 1976, Chinese leadership policy has much stressed the importance and necessity of foreign trade, including the importation of equipment, machinery, whole plants, and technology. The new prominence of trade has caused the state trading corporations to multiply, to grow in size, and to increase the speed of their activities, but at the moment the foreign businessman must still be patient both in his efforts to get to Peking and to negotiate while he is there.

The decisions to purchase from abroad are made not by the trade corporations but by their "end-users" and the ministries to which they are responsible. Even if these units wish to purchase from abroad, they must compete with each other for the allocation of scarce foreign exchange with which to make the purchase. The planning of purchases and their financing is time-consuming, and for these reasons the foreign seller must expect that a Chinese response to his approaches may be long in coming.

Also, the sheer weight of business on the trade corporations makes for long delay. The volume of correspondence which they must carry on, within China as well as with foreigners, is extensive. Negotiations occupy their time, as do frequent consultations with end-users. The size, many layers and caution of the trade bureaucracy make for slowness in decision-making.

There is no single best route which a foreign seller may use to get to Peking. Alternatives which should be pursued are letters with appropriate enclosures of technical literature directed to the relevant trade corporations and to the China Council for the Promotion of Foreign Trade in Peking, direct approaches to members of the commercial section of the PRC's Liaison Office in Washington, attendance at the Canton Fair, approaches to Chinese delegations visiting the United States, representation on scientific or industrial delegations to China, and engaging an experienced advisor or agent to assist, support and coordinate the seller's approaches to China. These means of approach should not be regarded as mutually exclusive. Without discussing them here, it should be noted that in many cases attendance at the Canton Fair by exporters does not produce substantive technical or commercial discussions, because the trade corporations normally do not send top-ranking officials to Canton to discuss purchases of items such as whole plants or complex equipment. The Fair, however, may be a useful forum for presentations, which are summarized and reported on when the Chinese officials at the Fair return to Peking.

Another route to the negotiating table is the technical seminar. The trade corporations have been increasingly interested recently in "technical exchanges" involving lectures and sometimes, demonstrations of equipment by technical specialists sent to Peking and occasionally to other Chinese cities by their companies. Such sessions offer an opportunity for sellers' representatives to talk directly to technically competent personnel representing the end-users themselves, which is not usually possible at the Canton Fair. Such technical seminars are expensive, involve considerable opportunity costs, and may not lead to commercial talks during the particular visit, but they are undoubtedly the most effective route which sellers can take in interesting end-users.

Another method of shortening the time which must elapse before a Chinese response is received is to translate considerable amounts of technical literature—not glossy advertising or a corporation's annual report—into modern Chinese and send it to the end-users directly, so that the recipients will not have to translate it themselves or pore over it in an unfamiliar language. Translation and printing services are provided by a number of organizations and companies in the United States and in Hong Kong.

If a foreign seller receives a response from Peking, it is usually a positive one, since if they're not interested, the trade corporations probably won't respond at all. When they do answer, they may ask for further information or for offers, or they may indicate an interest in holding negotiations in Peking. Upon receiving such invitations, the seller must then decide who to send.

B. Negotiations in Peking

It is usually a great mistake to send a representative of top management unless he has unusual competence to discuss his company's products. With due respect to the dignity and experience of high-ranking executives, the company representatives who make the best impressions on the Chinese are those who are most knowledgeable about the design and performance of their company's products. Obviously the seller must send a representative with authority to discuss price and other commercial details, and to negotiate and sign a contract. But it is in the technical sphere that it is vitally important to send particularly competent persons. As will be described below, competence becomes unusually important in the absence of good communications with the sellers' home office, which is a distinct and continuous problem in Peking.

The choice of personnel must be made, also, bearing in mind that the sellers' representatives may have to remain in Peking for weeks. The opportunity cost of sending very talented specialists to China may therefore be considerable. Men (or women) who are not cheerful about foreign travel, extended absences from home, long stays in hotels considerably more austere than those at home and the absence of night life may find themselves distinctly unhappy in Peking.

The negotiating team can fly to Peking from western Europe, Tokyo, or from Canton after having entered China via Hong Kong, although plane tickets are becoming harder to obtain because of the unprecedented Chinese push to increase tourism. If the travellers fly from Tokyo they may find that most of the seats on their plane are filled by Japanese businessmen, reflecting the considerable advantage Japanese exporters have over Americans in the China market by reasons of geographic proximity, pure competitiveness, and generally keener interest in exporting than most American companies.

Upon arrival in Peking, the sellers' team will be greeted by representatives of the trade corporation which has invited them. Americans are usually put up in the new wing of the Peking Hotel, which was erected four years ago and has spacious rooms. Most Japanese and some Europeans prefer the Hsin Chiao, which is smaller and older. Other hotels are also being used as the number of would-be sellers increases. The host corporations make these arrangements on behalf of visitors.

Once installed the sellers' team then falls into a more or less regular pattern. They breakfast early, and then, laden with briefcases and boxes of technical material, samples and plans, order a taxi to Erh li gou. The drive from the Peking Hotel is about twenty minutes, along roads shared with thousands of bicyclists, many large public buses, and a relatively small number of cars and trucks. If the visitors are staying at the Peking Hotel, they will be borne through Tien An Men, Peking's great square, past the entrances to the old Forbidden City and to Chiang-Nan-Hai, where China's top leaders live. It is impossible not to be stirred by the magnificent yellow-tiled roofs and red walls of the Forbidden City.

The ultimate destination, the "big important building," is considerably more mundane. As visitors arrive, many other taxis will be arriving at the same time, disgorging other businessmen—the majority of them Japanese—who have also come to negotiate. Until the spring of 1978, foreigners never even got above the ground floor, whose long, drab corridors are lined with doors opening into formal negotiating rooms of various sizes, always with long baize-covered tables separating one side of the room from the other. A brighter, newer, and larger multi-story building has been completed next door to the old one to serve as the center for negotiations. Each session begins the same way, with polite small talk about the weather and the offering of tea and cigarettes. The meetings usually begin at 8:30 a.m. at the earliest and end at 11:30, to resume at 2:30 and end at 5:30 p.m. One of the frustrations of this schedule is that, as willing as the seller might be to work longer hours in order to wind up the negotiations sooner, meetings outside normal hours are very rare.

C. Patterns

The Chinese participants will of course include representatives of the host organization, such as the China National Machinery Import and Export Corporation (often referred to for short by its cable address, "Machimpex"). In addition, representatives of the end-users may also be present. In some negotiations the end-users assume the predominant role until the very end, when price and commercial details are settled. Often, the end-user's team will include comparatively young and inexperienced personnel who are obviously present to learn. Machimpex or, sometimes the end-user, will provide an interpreter, and occasionally a relatively inexperienced interpreter may sit in for practice. Although the competence of the Chinese team, like their American counterparts, may vary considerably, the senior end-user personnel encountered recently have been particularly impressive and experienced, and the corporation negotiators are not without reason noted for being shrewd, careful, and observant of detail.

If the routine of negotiations is well-fixed, as has been suggested above, so, too, is their general over-all pattern. The Chinese will insist that all "technical" details should be discussed first, so that they will know exactly what the seller proposes to sell, before price and other contract terms are settled. Foreign sellers are usually surprised and often exhausted by the depth of detail which the Chinese side includes in the technical sphere. Sometimes, the questions may probe into details of design and research well within areas of information which the seller may regard as proprietary. On the other hand, when they discuss performance characteristics, the Chinese may be slow in coming forward with the climatic and other conditions under which they intend to use the seller's products, although their reticence may limit the seller's ability to discuss performance fully and slow the discussions. Sometimes the younger members of the Chinese team ask questions indicating much more unfamiliarity with the technology embodied in the sellers' product than that shown by their elders, who usually sit patiently while the sellers' representatives explain what they themselves may already know. It should be remarked, however, that the capacity of the Chinese side to absorb information quickly and learn from the negotiators is extremely high.

The relentlessness of the technical discussions can tire the sellers' representatives. Sometimes the questioners are youthful and eager, sometimes they are more experienced and very patient. Occasionally a whiff of faint mistrust may be felt from the Chinese side of the table, and indeed Chinese negotiators have sometimes remarked that on past occasions, especially in the early years of the People's Republic, they felt that they had been cheated by foreign sellers. The seller may be sure that whatever lines of inquiry appear at his sessions will be replicated at other meetings with his competitors, because once interest in particular products has been identified by the Chinese corporations, they seek out information from many sellers.

In the course of indicating the tasks they expect the sellers' product to perform, a number of recurrent emphases will usually emerge. The Chinese are sure to want the latest technology and the most advanced products, even if the seller may think them inappropriate for a developing country because of the level of training or experience which operators must have, problems of maintenance, or lack of other technology or equipment needed to attain the high levels of performance.

In their zeal for the latest and most modern equipment, the Chinese may want to automate operations usually performed manually; they often emphasize back-up systems and performance reliability to a particularly high extent. Consistent with their desire to obtain the most for their money, they may show great concern for the performance of the product over a very long period of time, a concern which may cause problems when warranties are discussed. They may want what the seller considers to be an over-engineered system, showing concern with maintenance, testing ard inspection. Safety considerations are also important. A recurrent and understandable concern is availability of spare parts, which often leads the Chinese to decide to purchase considerably more than sellers usually suggest or expect their purchasers to acquire, Also, in turnkey contracts, the Chinese will show concern for interchangeability of spare parts and equipment, and may specify sources and model numbers of equipment that they have already purchased in the past.

Another characteristic of negotiating with the Chinese corporations is the tenacity of their efforts to lower the seller's price. During technical discussions the Chinese side may express its expectations that the price should cover a considerable range of equipment which the seller does not ordinarily supply. In negotiations over the price itself, the seller may be told that his offer is "not competitive" or "above world market levels", or that he must "take a step forward". Often, the Chinese side may not even make a counter-offer, but continue only to whittle the price down.

No discussion of negotiating in Peking would be complete without considering the existence led by foreign sellers' representatives in that austere Northern capital. The Chinese hosts are certainly hospitable, and are pleased to arrange excursions to historic places such as the Great Wall and the Ming Tombs and to places of current interest such as factories and communes. Socializing with the Chinese side is limited to these occasions and to formal banquets which the two sides exchange from time to time. Apart from these contacts, however, the sellers' respresentatives are left to their own resources.

The hotels in which foreigners are housed offer little public space for entertainment or even lobby-sitting, and as a result the business visitor must use his room to entertain in, as well as to sleep and work. The isolation of the business visitor is dramatized when he goes out to one of Peking's fine restuarants for dinner. It is usually impossible to dine out unless the diner has made prior reservations and indicate the amount which he wishes to spend on the meal. At the specified hour he proceeds by taxi to the restuarant, where he will find a bustling place, full of the animation of ordinary Peking citizens eating in great good humor. However, the foreigner and his companions must usually dine in splendid isolation from the crowds, in a high-ceilinged room painted ochre or hospital green. The staff is usually good-humored and helpful, but the language barrier will normally prevent effective communication. The visitor and his companions must make their own party and then leave, in the taxi fetched for him by the restaurant staff.

Communications with the outside world remain a problem for foreigners in Peking. Cable charges to the United States are very high (37 cents per word), and the cable offices in the hotels close in the early evening. The hotels lack telex facilities, and should the business visitor want to send a telex he must order a taxi to take him to the central telegraphic office and there punch and send his own telex. He cannot receive incoming telex messages unless at the time he transmits his message someone at the receiving end wishes to reply while the line is open. A number of Japanese companies have their own telex facilities in Peking hotel rooms, and it is hoped that additional facilities will be made available for businessmen from other nations.

The foregoing has, it is hoped, given the reader an overview of negotiating with Chinese purchasers and the flavor of the life led in Peking by the foreign seller. The final outcome of successful negotiations is a contract which, like other aspects of Sino-foreign contacts, is likely to have certain patterns and characteristics of which the seller should be aware, and which are described in the following section.

II. CHINESE CONTRACT CLAUSES AND PRACTICE UNDER THEM [2]

The prospective seller is well advised to examine standard clauses in Chinese purchase contracts and more importantly, to educate himself about Chinese practice.[3] The pages which follow contain a summary which may be useful, both to sellers and others interested in Chinese attitudes toward international commerce.

A. *Shipment*

Chinese purchases from abroad usually are on F.O.B. or F.A.S. terms.[4] Although certain standard contract forms do not use the term "F.O.B." the clauses on these forms spell out the responsibilities of the parties in a manner consistent with the common understanding of the term. For instance, these contracts clearly specify the documents, including a "clean on board ocean bill of lading marked freight to collect," which the seller must present to the Bank of China when he wishes to negotiate a draft drawn on the letter of credit opened by the Bank. Another common clause states that the risk passes when the goods have "passed over the vessel's rail and been released from the tackle." [5]

Standard forms used by the Chemicals, Minerals and Metals, and Machinery Corporations contain clauses clearly identified as F.O.B. terms. These require the Chinese shipping agent, the China National Ship Chartering Corportion, to notify the seller of arrival of the vessel a fixed number of days before the arrival date.[6] The Machinery and Minerals and Metals Corporations require the seller to notify them 30 days before the agreed time of shipment, together with details of the shipment that will allow the Chartering Corporation to book shipping space accurately.

F.O.B. clauses may vary as to the calculation of liability for storage expenses in the event a seller has delivered cargo to the port of shipment as agreed but the Chinese vessel arrives late. The standard Chemicals Corporation form states that such losses are to be calculated "from the 16th day after expiry of the free storage time at the port," [7] while the standard Machinery Corporation clause simply states that if the Chinese vessel "fails to arrive at the port of loading within 30 days after the arrival date advised by the Buyer, the Buyer shall bear the storage and insurance expenses incurred from the 31st day.[8] Some flexibility may be shown in negotiations on this clause.

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[2] Portions of this section were previously published in Lubman, *Trade Between the United States and the People's Republic of China, Practice, Policy, and Law* 8 Law and Policy in Int'l. Business 1 (1976).

[3] A standard Machimpex Purchase Contract is reproduced as an Appendix and hereafter cited as "Machinery Contract". For a collection of standard Chinese contract forms see National Council for U.S.-China Trade, Special Report No. 13, Standard Form Contracts of the People's Republic of China (1975).

[4] Under an f.o.b. (free on board) contract the seller is required to make available at the port of loading the goods specified in the contract, and to pay all handling and transport charges for the goods specified in the contract, and to pay all handling transport charges for the goods up to the time of their passing over the ship's rail. *See* Schmittkoff, Export Trade, 14-15 (5th ed. 1969). Under f.a.s. (free alongside ship) terms the seller is not responsible for loading, and his responsibility ends when the goods are landed alongside the vessel so that they can be loaded. *Id.* at 12-13.

[5] Reghizzi, *Legal Aspects of Trade With China: The Italian Experience*, 9 Harv. Int'l J.85 (1968) at 101 n.54. Reghizzi comments that "[s]ome Italian businessmen have expressed their perplexity and difficulty in reconciling this clause with the subsequent right of the Chinese to inspect the goods and present claims after so many days have passed from the shipping of the commodities." *Ibid.*

[6] The machinery contract included in the Appendix specifies 10 days notice. Machinery Contract, cl. 12(1)(c). Contracts used by other corporations vary slightly.

[7] Chemicals Purchase Contract, "Terms of Delivery," cl. 1, in Standard Form Contracts, *supra* note 3, at 25.

Demurrage is an item to which the seller should be particularly attentive. When the Chinese purchase on F.O.B. terms they provide clearly that the seller is liable for demurrage if the goods are not ready when the vessel arrives at the port on time. However, the CIF terms are silent on demurrage, and sellers under these terms who have not insisted on demurrage clauses have suffered considerable losses when unloading of their vessels was delayed at congested Chinese ports.

B. Payment

1. STANDARD TERMS

The standard Chinese payment clauses provide that upon receipt of the shipping advice which the seller is required to send the Chinese buyer, the buyer will open an irrevocable letter of credit with the Bank of China, which is payable against presentation of a draft drawn on the Bank and the shipping documents described elsewhere in the contract. The letter of credit normally is valid until 15 days after shipment, and the documents are negotiated at a Bank of China branch in the P.R.C. The Chinese usually insist upon confirmed letters of credit in payment for their exports. When they are the buyers, however, they are well known for their reluctance to allow letters of credit to be confirmed. If during contract negotiations the seller asks for a confirmed letter of credit, the Chinese negotiator likely will say that there is no need to obtain confirmation. Insistence on it may be taken as an insult to the credit of the People's Republic of China.

The combined effect of the practices described above is that the seller who has shipped the goods and presented the documents loses control over both for a brief period of time.[9] Chinese letters of credit reportedly have contained clauses allowing inspection of the goods after they have arrived. These clauses theoretically would transform the letters of credit from irrevocable obligations into conditional promises to pay. This potentially troublesome practice has caused little difficulty, although delays in payment and deductions for alleged imperfections found on inspection have been known to occur.[10] Chinese practice apparently is not uniform, since other letters of credit clearly indicate that the transaction is a documentary one as is customary in international rade, and that the Bank of China will pay by airmail transfer provided that the "detailed name of the commodity, specifications, quantity, price, manufacturer and packing shown in the documents are found, upon presentation, to be in conformity with [with contract]." [11]

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[8] Machinery Contract, cl. 12(1)(c). Normally, title to the goods remains with the seller, who cannot be paid until the bill of lading has been transferred. It may be possible, however, to obtain Chinese agreement not only to pay for warehousing and insurance expenses after the 31st day, but also to pay for the goods themselves "against a warehouse receipt." J. Dingle, Technical Selling in China, at 36 (1974).

[9] Smith, *Standard Form Contracts in the International Commercial Transactions of the People's Republic of China* 21 Int'l & Comp L. Quart 142 (1972).

[10] Smith, for example, has "been told by British businessmen that in some cases of sales to the P.R.C. the letters of credit received only amount to 90 percent of the purchase price, and that the balance is sometimes used as a negotiating counter." *Id.* at 140.

[11] Bank of China Letter of Credit (on file with the author).

Considerable variation has occurred in the currency of payment employed. As in the case of Chinese exports, in recent years the Chinese have insisted on the use of their own currency as the medium of payment for their purchases. Recent contracts with foreign companies, however, have provided for payment in foreign currency, including U.S. dollars.

2. PAYMENTS UNDER TURNKEY CONTRACTS

The Chinese normally discharge their obligations under turnkey contracts by payment in cash. A typical contract may provide for payment of a total of 20 to 30 percent of the contract price at two stages prior to the first shipment of equipment, one at the signing of the contract, the other at an agreed-upon date some months thereafter. Most of the balance of the contract price would be paid as agreed-upon percentages of the invoice value of each shipment of equipment. The last two payments, often 5 percent each, would be paid respectively upon Chinese acceptance of the plant and expiration of the guaranty period. Another point at which payments might be made is upon the buyer's receipt of notification from the seller that the plant is ready for start-up.

The Chinese had long been known for their reluctance to purchase on credit terms except in the case of contracts for the purchase of agriculture commodities, which often provide for commercial credit up to 24 months. Since 1972, concurrently with the general increase in imports mentioned above, the Chinese have expressed a willingness to purchase whole plants on deferred payment terms. Most notably, the Chinese have purchased petrochemical plants from Japan on these terms. Several deferred payment contracts reportedly have provided for a downpayment of 20 percent, with the remainder payable at 6 percent over a 5-year period beginning with the completion of the plant. The Japanese Export-Import Bank, reversing a policy established in 1963, has begun to provide financing to manufacturers of goods exported to the P.R.C. to guarantee 80 percent of the annual obligation. Some purchases of plants from Western Europe also have been on a deferred payment basis, with equal guarantees furnished by Government export assistance programs in some cases.[12]

Chinese policy formerly emphasized unwillingness to borrow from abroad. At the same time, they demonstrated flexibility in using credit divices other than transactions clearly denominated as direct loans. According to one recent statement—

> China is a country with neither internal nor external debits. As before, we will not accept foreign loans or incur external debts.
>
> On the other hand, we will continue to use deferred payments, mutual deposit in banks and other practices customary in foreign trade and international finance.[13]

One device which has been used on occasion in the past has been supplier credit, in which a foreign bank finances a seller and is repaid when it receives from the seller drafts drawn by it on letters of credit opened by the Bank of China. Under such arrangements of course, although the Chinese purchasers are purchasing on credit, the source is the seller and not the buyer, and the transaction is formally not a loan. However, presumably the cost of such a credit arrangement is reflected in the price of the goods. More recently, in the spring of 1978, Chinese trade and financial officials began to express to foreign visitors their willingness to borrow directly from foreign banks and consortia.

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[12] For a table summarizing the terms of Chinese purchases of industrial plants and major components on a deferred payments basis during the period 1963 to September 1974, see Heymann, *Acquisition and Diffusion of Technology in China*, in China: a Reassessment of the Economy, Joint Economic Comm., 94th Cong., 1st sess., a Compendium of Papers 678, at 714–29. For a discussion of the technical but important question of calculation of the interest on deferred payments, see Dingle, *supra* note 8, at 30–31. Dingle indicates that the Chinese sometimes insist on paying interest on the face value of each payment rather than on the outstanding balances. *Ibid.*

[13] "Deputy Director of Kwangchow Fair on China's Foreign Trade," *Economic Reporter* (No. 4, October–December 1977) at 10.

C. Barter

Barter and other arrangements for reducing cash obligations such as counter-purchase and payback in product have been employed only rarely in Sino-Western trade in recent years.[14] In one barter transaction in 1973 when the Chinese purchased five sets of electrical generating equipment from a British company they reportedly paid for one with an assortment of products which included chemicals, foodstuffs and handicrafts. Generally, however, the Chinese have not favored barter because the products exchanged could be exported by foreigners to markets in which the bartered goods would compete with identical products sold by the P.R.C., usually at prices higher than the value assigned to them in a contract under which they were exchanged for goods.

D. Delivery

In contrast to the studied ambiguity of delivery dates in Chinese sale contracts, Chinese purchase contracts are quite exigent. A standard machinery import clause provides a penalty for late delivery which is fixed at a percentage of the contract price for each seven days up to a stated maximum, with a right given to the buyer to cancel the contract if delivery is delayed beyond 10 weeks.[15] The maximum varies, but is usually no higher than 5 percent. Contracts for whole plants also contain stiff penalty provisions. Under the standard clauses, the Chinese seem to have the right to cancel the contract for any late delivery (unless the force majeure clause applies) and to exact the penalty as well.[16] Sellers to the P.R.C. have had varying experiences under these clauses. Some, particularly steel sellers, have reported the Chinese to be unrelenting in their insistence that the penalty be paid. In other cases, the Chinese have agreed to extend the delivery time without a penalty, even though the clause did not specify a grace period. The difference may depend upon the need for the particular imports and also may be affected by the parties' prior relationship and the care with which the seller has documented the reason for the delay. In one case recounted to the author, the seller was also a buyer of Chinese exports who could point to frequently delayed Chinese deliveries which had caused him economic loss.

E. Force Majeure

Sellers frequently attempt to limit their liability for delayed delivery or non-devilery caused by acts over which they have no control, while buyers are equally resistant to the efforts. The P.R.C. has a history of highly stubborn and successful buyer resistance; for example, the Chinese are reluctant to define in detail the circumstances that constitute force majeure. A standard machinery clause states that the seller is not liable for delay for non-delivery due to force majeure, but the term is not defined in the contract.[17] The clause further requires the seller to notify the buyer immediately and follow that notification with "a certificate of the accident issued by the competent Government Authorities where the accident occurs." [18] If the force majeure lasts for more than 10 weeks, the Chinese buyers have the right to cancel the contract.

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[14] On barter in Sino-Italian trade, see Reghizzi, *supra* note 5 at 111–12.
[15] *See, e.g.*, Machinery Contract, cl. 17.
[16] *See* Smith, *supra* note 1, at 149.

Chinese corporations occasionally have agreed to specify some of the events which can be considered as instances of force majeure, such as "wars, or severe natural disasters." [19] Other force majeure clauses have been even more specific, such as one which includes "war, earthquake, flood, fire, explosion and other force majeure circumstances agreed upon by both parties or approved by arbitration in the case of disagreement by both parties." [20] For ideological reasons the Chinese usually have been unwilling to specify "acts of God," labor unrest, or strikes as instances of force majeure.

Regardless of the language of the force majeure clause, in practice the Chinese appear willing to recognize the principle that an intervening act beyond the seller's control may excuse him from a penalty for the late delivery. Some clauses have mentioned "any other acts beyond the control of the sellers", and others have included a statement that the seller's liability for delay is to be limited as a result of "other unavoidable circumstances" agreed to by the parties after the seller has invoked the clause.[21] Western European sellers who have had to invoke force majeure have stated that the Chinese generally have accepted the delay even though the actual cause was not specified in the contract.

F. Sellers' Guarantees: Inspection

Chinese insistence on purchasing the highest quality goods and holding sellers to the absolute letter of their agreement is partly reflected in a standard machinery import clause which requires that the seller:

> [G]uarantee that the commodity is made of the best materials, with first class workmanship, brand new, unused and complies in all respects with the quality specifications and performance as stipulated in this Contract. The Sellers shall guarantee that the goods, when correctly mounted and properly operated and maintained, shall give satisfactory performance for a period of . . . months counting from the date on which the commodity arrives at the port of destination.[22]

The guarantee period often extends to 12 or 18 months. Some negotiation is possible on the duration of the period and on when it begins to run (*i.e.*, from unloading at the port of destination or from arrival at the site).

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[17] Machinery Contract, cl. 16.

[18] *Id.*

[19] Reghizzi, *supra* note 5, at 110. This clause is drawn from a contract for the purchase of Italian goods, printed and completed in Peking. *Id.*

[20] *Id.* at 109.

[21] For a general discussion of the vagueness of the force majeure clauses, *see id.* at 110. Reghizzi concludes that, "So far no problems . . . seem to have arisen, and the Chinese have recognized at least two cases of *force majeure* confirmed by a declaration of the Chamber of Commerce of Milan." *Id.*

[22] Contract on file with the author. The clause in the machinery contract in the appendix omits the conditions of correct mounting and proper operation and maintenance. Machinery Contract, cl. 14.

Standard machinery clauses require the manufacturer to present a certificate of inspection regarding quality, specifications, performance and quantity, although the certificate is not considered final on those matters. The contract requires an additional inspection in China by the Commodity Inspection Bureau when the goods arrive. The standard clause provides that a claim may be asserted "on the strength of the Inspection Certificate" issued by the Bureau, "should the quality, specification or quantity be found not in conformity with the stipulations of the [c]ontract" within 90 days after arrival of the goods at the destination.[23] A claim also may be filed if the "damages occur in the course of operation by reason of inferior quality, bad workmanship or the use of inferior materials."[24]

Other clauses are worded slightly differently and include "improper design, inferior quality, bad workmanship and the use of bad materials" as the basis for claims.[25] The sellers are responsible for "the immediate elimination of the defects[,] complete or partial replacement of the commodity" or for a partial refund of the contract price.[26]

Even when contracts involve sales of whole plants or highly complex equipment, the Commodity Inspection Bureau also may be given a prominent role by the contract, although special tests out of the ordinary scope of the Bureau's activities may be involved. In such transactions, the standards which the plant or equipment must attain usually are derived from industrial standards common in the seller's business and are specified in detailed technical attachments to the contract. In contracts for the sale of whole plants, performance tests usually are carried out jointly under the instructions of the seller's personnel. Regardless of the standards used, inspections by the Chinese are rigorous.

Chinese practice has caused some difficulties for Western European and Japanese sellers, and can be expected to do the same in Sino-U.S. trade as well. So strict is Chinese insistence on adherence to the contract that several European manufacturers have been known to encounter Chinese complaints or even refusal to accept the goods when they shipped at no extra cost pieces of machinery that were newer models than those actually specified in the contract. Some European sellers have complained that sometimes the tests used by Chinese differ from the tests normally used in Europe. This difficulty perhaps may be prevented by specifying in the contract the relevant tests and standards which the Chinese will employ when the goods are delivered. In other cases the equipment may be so advanced that the Chinese lack the requisite technical expertise or highly sophisticated testing equipment. Compromise has been possible in these cases, but sometimes only with difficulty.

Additional contractual protection for the seller cannot be given by providing for joint inspection by representatives of the seller and buyer. Some turnkey contracts have specified that the Chinese may send their personnel to the seller's plant during delivery of the machinery. Clauses of this type, however, customarily state that the Chinese inspectors lack authority to countersign the certificates of quality which the seller is obligated to supply. The clauses also explicitly state that the attendance of Chinese inspectors does not affect the seller's guarantee. Turnkey contracts also provide for the seller to send his own representatives to the plant site to inspect machinery and equipment at their delivery, although, again, his guarantee remains unaffected. Regardless of the inspection arrangements agreed to by the parties, it is most unlikely that the Chinese will give up their practice of subjecting imported machinery and equipment to strict inspection.[27]

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[23] Machinery Contract, cl. 15.

[24] *Id.*

[25] Smith, *supra* 9, at 147.

[26] Machinery Contract, cl. 15.

The experience of sellers under these clauses has lead many to marvel at the meticulousness of Chinese inspections and the particularity of Chinese claims. Where other buyers of vehicles are content to purchase small spare parts by volume, such as a kilogram of piston rings, the Chinese count them one by one; where other buyers of steel pipe X-ray the pipe at random for cracks, the Chinese may X-ray every inch and make claims for hairline cracks which most buyers will ignore. The seller must be prepared for extraordinarily detailed inspections and for some uncommon, perhaps minor, claims. U.S. sellers of machinery often state that this care is in principle no greater than that exercised by inspectors in sales to the U.S. Government and to many other governments.

Unfortunately, the present imperfect framework of Sino-Western trade rarely provides an easy opportunity for easily arranged, face-to-face contact between representatives of buyers and sellers and for informal claims settlement. Sending the seller's personnel to the site to engage in joint inspection with the Chinese personnel can at least help in this respect, although Chinese rigor in these matters apparently is not abated when arrangements have been made with European sellers. Bureaucratic considerations may significantly stimulate Chinese readiness to assert claims and reluctance to settle them: Chinese officials presumably are not eager to bear the responsibility for ordering or accepting delivery of defective goods from abroad, nor do they wish to be responsible for failing to assert a claim based on defects or for wrongly settling such a claim. As a result, negotiations by Western sellers who have dealt with the Chinese over a period of years sometimes are conducted against a background of unresolved claims previously asserted by the Chinese, which may serve as bargaining counters during negotiations on other contracts.

G. Dispute Settlement

Consistent with the tenacity with which Chinese assert and resist settlement of claims is their practice in settling foreign trade disputes. The Chinese have a record of energetically avoiding not only litigation but any third-party participation having overtones of adjudication. A standard clause provides that, "[a]ll disputes in connection with this Contract or the execution thereof shall be settled [amicably] through negotiations."[28] In the event that the negotiations fail, the parties are limited by this clause to arbitration before the Foreign Trade Arbitration Committee (FTAC) in Peking. Some sellers have been able to obtain Chinese consent to arbitration in Sweden or in Switzerland, and a recent contract with a U.S. seller reportedly has specified Canada as the arbitral forum. Sometimes the contract will simply provide that arbitration will be held in an unnamed third country to be agreed upon by the parties.[29] In recent years the Chinese have become more willing to specify a third country as the arbitral forum, and to specify the arbitral body and the rules applicable to the arbitration proceeding.[30]

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[27] In contracts for the sale of whole plants, the parties will have agreed on the performance tests that must be run, as well as on payment of penalties by the seller according to a sale "reflecting the importance of the failed parameter(s)." Dingle, *supra* note 8, at 45. The contracts usually allow the seller to repeat the test. But it has been observed that "[i]n practice, since the penalty scales representing payment as liquidated damages apply only to relatively small failures, significant discrepancies from guaranteed parameters such as output, product quality, and consumption of raw materials and utilities, will involve the Seller in making modifications theoretically without limit." *Id.* at 49.

[28] Machinery Contract, cl. 18.

The Chinese long have expressed antipathy to choice-of-law clauses that subject any disputes to the rules of a designated foreign legal system, whether the seller's or that of a third country. Presumably, no legal system can be neutral, since the Chinese view law as an instrument by which ruling social classes maintain their dominance.[31] In at least one recent transaction, however, a Chinese corporation not only agreed to arbitration before a named third-country body under International Chamber of Commerce rules, but also agreed that the contract would be governed by the law of that country. Nonetheless, no matter what the clauses on dispute settlement and the applicable law in the contract provide, the most significant aspect of Chinese practice on these matters is their determination to avoid arbitration altogether.

To date it has been impossible to obtain a detailed account of any trade arbitration involving a Chinese corporation.[32] Some traders say that they will never ask for arbitration because they believe that the Chinese would consider the request to be "unfriendly," and that the request would endanger future business.[33] Other traders have said in private conversations that by either formally requesting or informally hinting that they were about to request arbitration they have brought about a prompt settlement. In other instances, however, the Chinese have been known not to respond at all. In one such case they are reported to have ignored the formal invocation of an arbitration clause while continuing to correspond with the European seller involved on all matters other than arbitration; eventually the claim was compromised. Moreover, some sellers who have negotiated a Chinese claim feel that in order to preserve the air of compromise they were forced to yield to some extent even when they were convinced that the claim was groundless or exaggerated.[34]

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[29] Machinery Contract, cl. 20.

[30] This opinion is based on contracts which have been shown to the author and on conversations with Western businessmen and officials of the Legal Affairs Department of CCPIT.

[31] *See, e.g.*, Institute of Civil Law of the People's Republic of China, Central Political-Legal Cadres School, Basic Problems in the Civil Law of the People's Republic of China 8 (Chung-Hua Jen-Min Kung-Ho Kuo Min-Fa Chi-Pen Wen-T'i, 1958), U.S. Joint Publications Research Service No. 4879 (1961): "Marxism-Leninism has always maintained that both law and jurisprudence possess a very intensive class character and can only serve the ruling class of a given period."

[32] Representatives of the American Arbitration Association were told that in 1974 over 100 cases that were brought to the attention of the FTAC were settled by "friendly negotiations," while 12 were settled on the basis of "non-binding recommendation" made by the FTAC, and only two cases in 1974 were settled by formal FTAC arbitration. Holtzmann, *Resolving Disputes in U.S.-China Trade*, in LEGAL ASPECTS OF U.S.-China Trade 77 (H. Holtzmann, ed. 1975). The Holtzmann account offers a fascinating recapitulation of the Chinese emphasis on avoiding arbitration and on maintaning fluid and informal devices for disputes settlement.

For a recent Chinese view, see *Primer on International Trade* (translation of Writers Group of the Foreign Trade Department of the Liaoning Fiscal Institute, Primer on International Trade), 8 Chinese Economic Studies, Winter 1974–75, at 32–33:

> Cases conducted within the arbitration systems of capitalist countries are usually not public, and the written rulings more than half the time do not give reasons for the decisions made. Our nation's foreign trade arbitration system operates in accordance with the "Temporary Rules of the Foreign Trade Arbitration Committee of the Chinese Council for the Promotion of International Trade." Unless the parties involved in the dispute demand otherwise, the cases are heard publicly. Reasons are always given for the rulings. Moreover, our country's foreign trade arbitration system relies on a spirit of cooperation between arbitration and mediation. We try whenever possible to solve disputes through mediation, doing everything we can do to help the two sides reach an agreement through the principles of negotiation and voluntarism and, by reaching an amiable settlement, promote the development of mutual trade.

[33] Reghizzi indicates that "[e]ven the suggestion that a dispute be submitted to arbitration in Peking is met with disfavor." Reghizzi, *Law and Sino-Italian Trade*, in Law and Politics in China's Foreign Trade 184 (V. Li ed. 1977).

Another illustration of the Chinese preference for non-adjudicated dispute settlement, which has recently received attention in a Sino-U.S. dispute, is a strong emphasis on conciliation. An authoritative Chinese statement on the subject reads:

"In concrete work, the [Foreign Trade Arbitration Commission] and the [Maritime Arbitration Commission] adopt the method of combining arbitration with conciliation . . . Experience proves that most of the cases . . . can be settled by conciliation in the course of investigation or examination, prior to the arbitration proceedings or before an award is granted . . . . "[35]

Recently, a dispute betwen an American commodities seller and a Chinese buyer was resolved through a form of conciliation devised by the Legal Department of the China Council for the Promotion of International Trade and by the American Arbitration Association. Conciliators appointed by the two parties met in Peking in October, 1977, and arrived at a mutually satisfactory basis for resolution of the agreement in the course of a ten-day period.[36]

The cooperation between the Chinese and U.S. sides is innovative and encouraging. However, it should be realized that the more institutionalized conciliation becomes, the greater the difficulties are likely to be encountered by the American disputant who wishes to stop negotiating and bargaining over the terms of a settlement and wants to proceed to a definitive third-party adjudication. At any rate, this recent case of joint conciliation is a development that American and other foreign sellers should watch with interest.

Improvisation of bilateral efforts to settle trade disputes offers considerably more hope for reaching solutions satisfactory to the American side than the unrealistic suggestion that the United States and the P.R.C. should agree that "legal and natural persons ought to have access to the domestic courts of the two countries." [37] Not only do U.S. corporate counsel not know enough about the Chinese legal system to enable them to decide whether they want to seek remedies in Chinese courts, but the considerable amount of general information available on the Chinese legal system suggests that the basic assumptions underlying that system are too different, and its rules too indefinite and difficult to ascertain, for U.S. sellers realistically to prefer Chinese domestic courts to Chinese or third-country trade arbitration. The Chinese have avoided using courts to settle trade disputes, a preference that helps to explain the creation of Chinese trade arbitration bodies. Moreover, it is highly unlikely that the Chinese corporations would want access to U.S. courts; lawsuits initiated by Chinese commercial entities in any foreign court since 1949 are extremely rare. On balance, U.S. sellers and their advisers, while seeking to devise novel methods of bilateral dispute settlement, are also advised to continue probes and general discussions and, like European veterans of trade with the P.R.C., to press for third-country arbitration.

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[34] *Ibid.*

[35] Jen Tsien-Hsin and Liu Shao-Shan, "Arbitration in China", p. 3 (mimeographed copy given to the author in Peking in March, 1978.

[36] China Business Review, Nov.-Dec., 1977

[37] Theroux, *Legal and Practical Problems in the China Trade*, China: A Reassessment of the Economy Joint Economic Comm., 94th Cong., 1st sess., A Compendium of Papers 533, 588 (1975).

H. Industrial Property

1. PATENTS AND KNOW-HOW

Contract clauses on protection of foreign patents and know-how in the P.R.C. are particularly important since there is no Chinese statutory scheme for their protection. A P.R.C. statue permits P.R.C. citizens or foreign individuals or groups to register invention and receive cash awards,[38] but all inventions, apparently including those unregistered, become the property of the P.R.C. Accordingly, the only way a foreign seller can protect his rights in his industrial property is by bargaining for a contract clause that will afford him protection.

The China National Technical Import Corporation, which negotiates for the purchase of whole plants, is likely to be involved in negotiating the clause, In a few rare occurrences, the Technical Import Corporation has purchased technology without also buying equipment, as when it negotiated with the Berliet Company of Paris for licenses to manufacture trucks. Generally, however, purchases of technology occur in the context of a whole-plant purchase. Practice apparently varies on whether the license has a specified portion of the contract price assigned to it, or whether it is included in that price,[39] but there apparently are never any payments of royalties. The provisions covering patents and knowhow make the agreement a lump-sum sale. The actual payments may be completed at the time the plant begins operations or may be included in the installments paid under deferred payment terms.

The foreign seller of technology must rely on the contract to protect him against use of his industrial property in ways extending beyond the scope of the contract, either by Chinese duplication of it or by Chinese disclosure or subsequent unlicensed transfer. Officials of the CCPIT Legal Affairs Department with whom this question has been discussed have acknowledged that the Chinese side must be willing to provide the protection, and the Technical Import Corporation, which has negotiated licenses with foreign licensors, has concurred. In some contracts, the Technical Import Corporation has agreed never to disclose the licensed technology; in other contracts nondisclosure has been limited to a period of years. The original license usually assumes a fixed periodic output at a disclosed number of plants, but the Chinese sometimes wish to use the licensed process in other plants. In varying language the Technical Import Corporation has agreed not to duplicate a plant utilizing the process covered by a license, subject to a Chinese right to improve the plant or plants covered by the license and to increase production at those plants without any obligation to the seller. The Technical Import Corporation at times has sought to obtain the licensor's approval of unlimited use of the licensed technology. One licensor retained the technology for production of a vital catalyst, and can measure Chinese production by their purchases of the catalyst from the licensor.

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[38] Regulations of Nov. 3, 1963, Concerning Awards for Inventions, [1964] 13 Chung-Hua Jen-Min Kung-Ho-Kuo Fa-Kuei Hul-Pien [FKHP](Compilation of Laws and Regulations of the Peoples' Republic of China 241. For English translation, see U.S. Consulate, Hong Kong, Survey of the China Mainland Press, No. 3117, Dec. 11, 1963 at 6.

[39] This variation has been described to the author in private conversation with representatives of European and American companies who have discussed licensing with the Technical Import Corporation. It has also been reported in *How China Buys Foeign Technology*, Bus. Int'l, Dec. 5, 1972, at 396.

Consistent with its preference for lump-sum purchases, the Technical Import Corporation often has been willing to forego the right to make use of future improvements of a process by the licensor if further payments would be required. Certain licensing agreements, however, require the licensor to continue to inform the Chinese licensee of improvements for a stated period of time. often as a minimum until the plant begins operations. On the other hand, the Technical Import Corporation has been unwilling to agree to disclose subsequent Chinese improvements.

Foreign sellers often seek to prohibit the P.R.C. from exporting products manufactured by the plants. It is difficult to determine how readily the Technical Import Corporation will agree to this restriction. The author has been informed that in at least one agreement with a Japanese licensor, the Corporation has agreed that the products would not be exported.

2. TRADEMARKS

Although no known contract has involved the use of a foreign trademark in the P.R.C., Chinese legislation on trademarks has created a framework for dealing with this type of industrial property.[40] A Chinese statute specifically permits a foreign enterprise to register marks to which it has rights in its own country [41] if that country has reached an agreement with the P.R.C. on the reciprocal recognition of trademarks.[42] Nationality of the applicant appears to be the governing criterion of belonging to a foreign country.[43] The precise language of the statute suggests that it may be possible for protection to be given to an applicant from a country that has not formally concluded an agreement, but that protects Chinese trademarks by virtue of its own laws, as is the case with the United States.[44]

Indeed, early in 1978 the Chinese government announced that registration of foreign trademarks in Peking would be permitted according to the principle of reciprocity. As a result, U.S. trademarks may now be registered in Peking, although the United States and China have not concluded an agreement on the subject. Similarly, this writer has been informed that reciprocity will determine other aspects of registration. Formerly, for instance, registrants in Peking had to file copies of their original certificates of registration, but now that requirement will be dispensed with whenever it would not be imposed on foreign applicants by the registrant's country.

Invocation of reciprocity by the Chinese in trademark matters has a variety of implications. Obviously it will interest U.S. manufacturers who are zealous about extending protection of their often very highly valuable trademarks. In addition, this development may reflect the interest of Chinese trade corporations in protecting their own trademarks, particularly since some of them are exporting products bearing brand names used in China before 1949, and that are now being used by the former owners doing business from Taiwan. The Chinese action also raises another interesting question: does invocation of international reciprocity reflect increased Chinese interest in international legal practice? Recent emphasis throughout China on developing domestic legal institutions suggests that Chinese interest in formal legal institutions has noticeably increased.

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[40] For a discussion of China's application of trademark laws and regulations, see Randt, *Trademark Law in the PRC: Case Fables with Morals for Western Traders*, U.S.-China Bus. Rev., May-June 1974, at 3.

[41] Regulations of Apr. 10, 1963, Concerning the Control of Trademarks, [1964] 13 FKHP 162 [hereinafter cited as Regulations on Control of Trademarks]; Rules of Apr. 25, 1963, Concerning the Implementation of the Regulations Governing the Control of Trademarks, [1964] 13 FKHP 164.

[42] Regulations on Control of Trademarks, § 12(1).

[43] *See* Implementing Regulations, *supra* note 41 at §§ 16, 20. These regulations make specific reference to the "certificate of nationality" which foreign enterprises must file. *Id.*

[44] It should be noted that the registration process is simple and inexpensive, consisting of filing a single application with the Legal Affairs Department of CCPIT, which must be given a power of attorney by a notarized document. The fee for regulation is a nominal RMB 20, approximately $12.00 at the rate of exchange prevailing in late May, 1978.

III. Recent Developments in Chinese Policies Toward Law

For over twenty years formal legal institutions have had little importance in China.[45] From 1949 to 1957 China experimented, with varying degrees of commitment and intensity, with a legal system based on that of the Soviet Union. A three-tiered judicial system was established, law schools began to train the nucleus of a small bar, and attempts were made to institutionalize substantive and procedural rules. These activities were repeatedly interrupted by wave after wave of mobilizational social and economic change which destroyed landlords and urban bourgeoisie alike and brought about the socialization of China's economy.

Throughout these early years, certain conflicts over basic ideas of leadership, administration and policy-implementation remained unresolved in the legal system. The relative roles of objective standards as against the subjective judgements of administrative cadres, rules rather than persuasion, legal specialists rather than political generalists, were not clearly defined. Yet as part of the drive to industrialize China the framework of a modern legal system was established, some legal specialists were trained, and many laws and regulations were promulgated. By 1956 work was begun on law codes, several legal periodicals were publishing regularly, and the small bar was beginning to become active.

However, attempts to regularize and expand the legal system foundered in 1957, when China's leaders, greatly concerned at the vehemence of much of the criticism that was expressed during the "Hundred Flowers" of 1956–1957, launched a campaign against "rightism". Among the chief targets of the campaign were the legal specialists and the codes and objective standards they had favored. The specialists had complained at the gaps in the law, the failure to make progress on the new codes, and the disregard of established laws and procedures by many cadres. As a result of the campaign many legal specialists lost their jobs, codification projects were suspended, and the content of legal curricula was greatly politicized.

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[45] It is impossible in the brief space available to trace the complicated history of Chinese policies toward law The interested reader would be well advised to consult an excellent overview, Victor H. Li, Law Without Lawyers (1977). The roots of the Chinese Communist policies toward law lie in the history of the Chinese Revolution itself. *See e.g.*, S. Leng, Justice in Communist China 1–76 (1967). For a broad interpretation of Chinese Communist attitudes toward law, see Li, *The Role of Law in Communist China*, China Q., Oct.–Dec. 1970, at 66.

On criminal law, J. Cohen, The Criminal Process in the People's Republic of China 1949–1963 (1968). contains many translations of Chinese materials and a useful chronological discussion and an analysis of developments in the Chinese legal system to the mid-1960's. For other work on Chinese criminal law, see Li, *The Evolution and Development of the Chinese Legal System*, in China: Management of a Revolutionary Society 221 (J. Lindbeck, ed. 1971); Lubman, *Form and Function in the Chinese Criminal Process*, 69 Colum. L., Rev. 535 (1969).

No general Western language text or collection of materials on civil law has yet been published. For selected civil law topics, see Lubman, *Methodological Problems in Studying Chinese Communist "Civil Law"*, in Contemporary Chinese Law; Research Problems and Perspectives 230 (J. Cohen ed. 1970); Huang, *Reflections on Law and the Economy in the People's Republic of China*, 14 Harv. Int'l L. J. 261–285, 89 (1973); Lubman, *Mao and Mediation: Politics and Dispute Resolution in Communist China*, 55 Calif. L. Rev. 1284 (1967); Pfeffer, *Contracts in China Revised, With a Focus on Agriculture, 1949–63*, 28 China Q. 106 (1966).

Since 1957 the courts have been little used in China, most of the few thousand lawyers trained before then were assigned to other jobs, and some functions of the courts such as sanctioning for minor offenses were distributed to the police, to local neighborhood organizations in the cities and lower levels of the rural communes, and to work units such as factories and offices. The procuracy, a prosecutorial institution established during the nineteen-fifties, disappeared.

The Cultural Revolution saw yet further attacks on the formal legal system, including the police, which was for years supplanted by the People's Liberation Army in its role of maintaining public order. During the early nineteen-seventies the police reappeared, the law courts were occasionally mentioned in the press, and at least one law department, at Peking University, began to be more active again. However, not until early 1978 has law been prominently mentioned, either in the sense of denoting a set of desirable institutions or as an academic discipline. In the wake of the overthrow of the "Gang of Four", as China's leadership firmly attempts to set China upon a course of economic modernization, it has obviously given thought to using law to strengthen China's administrative system.

In March, 1978, a new Constitution was adopted by the Fifth National People's Congress. Although like other Chinese constitutions it is both a programmatic statement as well as a framework for the structure of the Chinese state, it contains separate sections devoted to the courts and to the newly reappeared procuracy, and to citizens' fundamental rights. In addition, strong signs have appeared of a leadership policy to reconstruct and develop China's legal institutions.

In February, 1978, it was announced that the newly-established Chinese Academy of Social Sciences included a Law Institute, which was going to offer graduate courses. Han Yu-t'ung, the Deputy Director of the new Institute, has since made several interesting statements which apparently reflect official policy. In an interview in late February she accused the "Gang of Four" of having sabotaged the police and the courts, and stressed the need to follow orderly procedures in handling criminal cases.[46]

Notably, on March 16, 1978 Han Yu-t'ung published an important article in the People's Daily entitled "Smash Spiritual Shackles—Do Legal Work Well",[47] the article calls for law-making and discipline according to law in terms that have not been used in China for many years. The article blames the failure to formulate necessary laws and to revise others on the "Gang of Four"; some observers would trace the deemphasis of law farther back, as has been suggested above. More striking than the focusing of blame for neglect of law, however, is the call for new activity.

The article says that Chairman Mao himself stated in 1962 that "it won't do to have no law", and a program of law-making is proposed:

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[46] "Deputy Director of Law Institute Discusses Socialist Legality", People's Republic of China Mission to the United Nations Press Release No. 12, 21 Feb. 1978.

[47] *People's Daily*, Peking, March 16, 1978, p. 3.

"To strengthen socialist legality", the article says, "we must first of all proceed with legislative work on a large scale." To do this, "necessary legal organs and legal institutions must be revived and established", and legislation on "criminal law, criminal procedure, civil law and civil procedure" should be enacted, as well as "important laws on economic construction". Much revision of existing law is necessary, as well as strengthening of existing legal organs. In addition, "leading organizations and leading cadres must become models in carrying out and following the constitution and the law." The article called also for developing popular education about legality on a large scale throughout the media.

The article signifies an end to the long hiatus in Chinese law-making, and suggests that China's leaders are beginning to stress the importance of regularized rules for China's current modernization efforts. The link between law-making, law observance and the education of cadres and masses is also significant because officials and population alike have in the past often been encouraged to be impatient with rules and regulations. Recent signs that the new policy is being implemented were apparent when this author visited Canton in April, 1978: A statute originally promulgated in 1957, providing for police punishment of minor violations of public order, had been promulgated and posted in downtown Canton; outside the offices of a neighborhood residents' committee a poster urged all to support Chairman Hua's call to strengthen the socialist legal system.

Even more recently, *Red Flag*, the Chinese Communist Party's theoretical monthly, featured an article by Chiang Hua, President of the Supreme People's Court, calling for enforcement of the new constitution and for improvement of the legal system.[48] Emphasis is laid on the need for cadres to obey the law and party discipline, and on protection of persons who "expose bad persons and deeds in state institutions." The need for orderly and regularized judicial procedure is explicitly recognized. Elsewhere, authoritative statements by local leaders [49] and in the media have echoed the themes articulated in Han Yu-t'ung's article summarized above.[50]

Although the emphasis on legality has been expressed only very generally and very recently, its reappearance in China is noteworthy and invites speculation on its significance. It certainly suggests that the Chinese leadership is committed to orderly, structured leadership and administration of economic development. To some extent socialist legality will probably be used to reinforce discipline, as it was during the mid nineteen-fifties, the last time heavy industrialization, constitutionalism and the rule of law were simultaneously stressed in China.

But the language of the most recent Chinese articles also suggests that the making and application of rules and regulations may be used soon to systematize China's apparatus of government. Conversations with legal specialists in Peking in March 1978 suggested that codification projects would be resumed and that many laws would be revised and harmonized. Han Yu-t'ung's article specifically mentioned the need for "important laws on socialist construction". Since 1949 great quantities of internal bureaucratic regulations have been promulgated to direct the activities of economic units and their relations with each other. China's current modernization drive could well produce legislation expressing general principles of economic administration that until now have not been articulated. Legal and economic planning officials stated in July 1978 that drafts of such principles were being circulated internally.

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[48] Red Flag on New Constitution, Socialist Legal System, FBIS Daily Report, China, 11 May 78, p. E7.

[49] See, e.g., "Kiangsu Meeting on Public Security, Judicial Work in Nanking", FBIS Daily Report, China, 10 May 78, p. G4.

[50] "Call for Rule of Law" [Report on *Liberation Army Daily* 7 May Editorial: "Be Models in Abiding by the Constitution and Obeying the Rule of Law", FBIS Daily Report, China, 10 May 78, p. E 10.

Much more difficult to predict is the significance, if any, of the domestic emphasis on legality for China's international economic relations. Can the new attention to legality at home in any way be a harbinger of increased Chinese interest in international trade law and practice? Perhaps it is not coincidental that Chinese invocation of the principle of reciprocity in trademark registration, noted above, should come at this time. It is too early to tell. At the moment, no direct relationship can be ascertained between China's domestic legality and international trade practice—but the strengthening of legality may reflect a cast of mind and a relative doctrinal openness that could lead to receptivity to new ideas and to flexibility in foreign trade. Of interest in this regard is an apparent increase in the number of lawyers' delegations being invited to China. A Canadian bar delegation visited China in early 1978, and two groups from the American Bar Association were scheduled to visit China in 1978. The first, led by Association President William A. Spann, Jr. in July, which apparently was allowed to learn more about Chinese legal institutions than previous visitors, traveled as official guests of the China People's Friendship Association. This delegation was told by high-ranking officials that law codes were being prepared, and throughout the visit the regular operation of the formal legal system was emphasized.

Whether increased contacts with foreign lawyers will eventually influence Chinese negotiating practice and contracts is of course impossible to predict. Negotiations of the type described at the beginning of this essay have usually been conducted without significant reference to practice and precedents other than those of the Chinese trade corporation involved. It is not impossible these days to invoke and discuss conventional international practice in some matters, although obtaining the assent of Chinese negotiators to change contract language that has long been in use is, as anywhere else in the world in similar situations, difficult. Yet if the emphasis on legality and the new attention to law are continued, it may be that Chinese practice in international trade will also reflect the influence of the new policy. As China imports more technology and licensors insist on a more evident willingness to protect patents and know-how, China may show greater interest in the international patent system. In this manner changes in domestic development policy may cause China to move closer to formal adherence to prevailing norms of international trade law. In the meantime, current policies suggest that Chinese legal institutions may be reemerging as significant components of the Chinese State.

Appendix

CONTRACT

No____

Peking, Date_______________________________________

The buyers:

China National Machinery Import and Export Corporation, Erh-Li-Kou, Hsi Chiao, Peking, China. (Cable Address: "Machimpex" Peking)

The Sellers:

This Contract is made by and between the Buyers and the Sellers; whereby the Buyers agree to buy and the Sellers agree to sell the undermentioned commodity according to the terms and conditions stipulated below:

1. *Commodity, Specifications, Quantity and Unit Price:*
2. *Total Value:*
3. *Country of origin and Manufacturers:*
4. *Packing:* To be packed in strong wooden case(s) or in carton(s), suitable for long distance ocean parcel post air freight transportation and to change of climate, well protected against moisture and shocks. The Sellers shall be liable for any damage of the commodity and expenses incurred on account of improper packing and for any rust attributable to inadequate or improper protective measures taken by the Sellers in regard to the packing. One full set of service instructions for each instrument shall be enclosed in the case(s).
5. *Shipping Mark:* The Sellers shall mark on each package with fadeless paint the package number, gross weight, net weight measurement and the wordings: "Keep Away From Moisture", "Handle With Care", "This Side Up" etc., and the shipping mark:
6. *Time of Shipment:*
7. *Port of Shipment:*
8. *Port of Destination:*
9. *Insurance:* To be covered by the Buyers after shipment.
10. *Payment: for/by*

    (1) In case by L/C: The Buyers, upon receipt from the Sellers of the delivery advice specified in Clause 12 (1)(a) hereof, shall 15–20 days prior to the date of delivery, open an irrevocable Letter of Credit with the Bank of China, Peking, in favour of the Sellers, for an amount equivalent to the total value of the shipment. The Credit shall be payable against the presentation of the draft drawn on the opening bank and the shipping documents specified in Clause 11 hereof. The Letter of Credit shall be valid until the 15th day after the shipment is effected.

    (2) In case by Collection: After delivery is made, the Sellers shall send the shipping documents specified in Clause 11 hereof, from the Sellers' Bank through Bank of China, to the Buyers for collection.

    (3) In case by M/T or T/T: Payment to be effected by the Buyers within seven days after receipt of the shipping documents specified in Clause 11 of this contract.
11. *Documents:* The Sellers shall present to the paying bank the following documents for negotiation:

    (1) In case by freight:

    3 Negotiable copies of clean on broad ocean Bill of Lading marked "Freight To Collect" "Freight Prepaid", made out to order, blank endorsed, and notifying the China National Foreign Trade Transportation Corporation at the port of destination.

    In case by air freight:

    One copy of Airway Bill marked "Freight Prepaid" and consigned to the Buyers.

    In case by post:

    One copy of Parcel Receipt addressed to the Buyers.

    (2) 5 copies of Invoice with the insertion of Contract No. and the Shipping Mark. (in case of more than one shipping mark, the invoice shall be issued separately).

    (3) 2 copies of Packing List issued by the Manufacturers.

    (4) 1 copy of Certificate of Quantity and Quality issued by the Manufacturers.

    (5) Certified copy of cable/letter to the Buyers, advising shipment immediately after shipment is made.

    (6) The Sellers shall, within 10 days after the shipment is effected, send by air-mail two sets of the abovementioned documents (except Item 5)-One set to the Buyers and the other set to the China National Foreign Trade Transportation Corporation at the port of destination.
12. *Shipment:*

    (1) In case of FOB Terms:

    a. The Sellers shall, 30 days before the date of shipment stipulated in the Contract, advise the Buyers by cable/letter of the Contract No., commodity, quantity, value, number of package, gross weight and date of readiness at the port of shipment for the Buyers to book shipping space.

b. Booking of shipping space shall be attended to by the Buyers' Shipping Agents Messrs. China National Chartering Corporation, Peking, China. (Cable address: Zhongzu Peking)

c. China National Chartering Corporation, Peking, China, or its Port Agents, (or Liners' Agents) shall send to the Sellers 10 days before the estimated date of arrival of the vessel at the port of shipment, a preliminary notice indicating the name of vessel, estimated date of loading, Contract No. for the Sellers to arrange shipment. The Sellers are requested to get in close contact with the shipping agents. When it becomes necessary to change the carrying vessel or in the event of her arrival having to be advanced or delayed the Buyers or the Shipping Agent shall advise the Sellers in time. Should the vessel fail to arrive at the port of loading within 30 days after the arrival date advised by the Buyers, the Buyers shall bear the storage and insurance expenses incurred from the 31st day.

d. The Sellers shall be liable for any dead freight or demurrage, should it happen that they have failed to have the commodity ready for loading after the carrying vessel has arrived at the port of shipment on time.

e. The Sellers shall bear all expenses, risks of the commodity before it passes over the vessel's rail and is released from the tackle. After it has passed over the vessel's rail and been released from the tackle, all expenses of the commodity shall be for the Buyers' account.

(2) In case of C&F Terms:

a. The Sellers shall ship the goods within the shipment time from the port of shipment to the port of destination. Transshipment is not allowed. The contracted goods shall not be carried by a vessel flying the flag of the country which the Buyers can not accept. The carrying vessel shall not call or stop over at the port/ports of Taiwan and/or the port/ports in the vicinities of Taiwan prior to her arrival at the port of destination as stipulated in Clause 8 of this Contract.

b. In case the goods are to be dispatched by parcel post/air-freight, the Sellers shall, 30 days before the time of delivery as stipulated in Clause 6, inform the Buyers by cable/letter of the estimated date of delivery, Contract No., commodity, invoiced value, etc. The sellers shall, immediately after dispatch of the goods, advise the Buyers by cable/letter of the Contract No., commodity, invoiced value and date of dispatch for the Buyers to arrange insurance in time.

13. *Shipping Advice:*

The Sellers shall, immediately upon the completion of the loading of the goods, advise by cable/letter the Buyers of the Contract No., commodity, quantity, invoiced value, gross weight, name of vessel and date of sailing etc. In case the Buyers fail to arrange insurance in time due to the Sellers not having cabled in time, all losses shall be borne by the Sellers.

14. *Guarantee of Quality:*

The Sellers guarantee that the commodity hereof is made of the best materials with first class workmanship, brand new and unused, and complies in all respects with the quality and specification stipulated in this Contract. The guarantee period shall be 12 months counting from the date on which the commodity arrives at the port of destination.

15. *Claims:*

Within 90 days after the arrival of the goods at destination, should the quality, specification, or quantity be found not in conformity with the stipulations of the Contract except those claims for which the insurance company or the owners of the vessel are liable, the Buyers shall, on the strength of the Inspection Certificate issued by the China Commodity Inspection Bureau, have the right to claim for replacement with new goods, or for compensation, and all the expenses (such as inspection charges, freight for returning the goods and for sending the replacement, insurance premium, storage and loading and unloading charges etc.) shall be borne by the Sellers. A regards quality, the Sellers shall guarantee that if, within 12 months from the date of arrival of the goods at destination, damages occur in the course of operation by reason of inferior quality, bad workmanship or the use of inferior materials, the Buyers shall immediately notify the Sellers in writing and put forward a claim supported by Inspection Certificate issued by the China Commodity Inspection Bureau. The Certificate so issued shall be accepted as the base of a claim. The Sellers, in accordance with the Buyers' claim shall be responsible for the immediate elimination of the defect(s), complete or partial replacement of the commodity or shall devaluate the commodity according to the State of defect(s). Where necessary, the Buyers shall be at liberty to eliminate the defect(s) themselves at the Sellers' expenses. If the Sellers fail to answer the Buyers within one month after receipt of the aforesaid claim the claim shall be reckoned as having been accepted by the Sellers.

16. *Force Majeure:*

The Sellers shall not be held responsible for the delay in shipment or non-delivery of the goods due to the Force Majeure, which might occur during the process of manufacturing or in the course of loading or transit. The Sellers shall advise the Buyers immediately of the occurrence mentioned above and within fourteen days thereafter, the Sellers shall send by airmail to the Buyers for their acceptance a certificate of the accident issued by the Competent Government Authorities where the accident occurs as evidence thereof.

Under such circumstances the Sellers, however, are still under the obligation to take all necessary measures to hasten the delivery of the goods. In case the accident lasts for more than 10 weeks, the Buyers shall have the right to cancel the Contract.

17. Late Delivery and Penalty:

Should the Sellers fail to make delivery on time as stipulated in the Contract, with exception of Force Majeure causes specified in Clause 16 of this Contract, the Buyers shall agree to postpone the delivery on condition that the Sellers agree to pay a penalty which shall be deducted by the paying bank from the payment under negotiation. The penalty, however, shall not exceed 5% of the total value of the goods involved in the late delivery. The rate of penalty is charged at 0.5% for every seven days, odd days less than seven days should be counted as seven days. In case the Sellers fail to make delivery ten weeks later than the time of shipment stipulated in the Contract, the Buyers shall have the right to cancel the contract and the Sellers, in spite of the cancellation, shall still pay the aforesaid penalty to the Buyers without delay.

18. Arbitration:

All disputes in connection with this Contract or the execution thereof shall be settled through friendly negotiations. In case no settlement can be reached, the case may then be submitted for arbitration to the Arbitration Committee of the China Council for the Promotion of International Trade in accordance with the Provisional Rules of Procedures promulgated by the said Arbitration Committee. The Arbitration shall take place in Peking and the decision of the Arbitration Committee shall be final and binding upon both parties; neither party shall seek recourse to a law court or other authorities to appeal for revision of the decision. Abritration fee shall be borne by the losing party. Or the Arbitration may be settled in the third country mutually agreed upon by both parties.

19. Special Provisions:

In Witness Thereof, this Contract is signed by both parties in two original copies; each party holds one copy.

The Buyers:
China National Machinery Import
and Export Corporation

The Sellers:

AN ANALYSIS OF CHINA'S HARD CURRENCY EXPORTS: RECENT TRENDS, PRESENT PROBLEMS, AND FUTURE POTENTIAL

By Hedija H. Kravalis*

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I. Introduction

In 1977, China embarked upon a foreign trade policy designed to support its economic development and to hasten the modernization of its industry, agriculture, science and technology, and national defense. To implement its foreign trade objectives, China's leadership is advocating selective use of technology imports to speed the development of critical sectors of the economy, but at the same time, is emphasizing that China will remain basically self-reliant, and adhere to a policy which excludes financing imports by a buildup of foreign debt. To pay for expanded imports, China must, therefore, expand its exports.[1] In the near to medium term,[2] one of the most important among all variables affecting China's trade prospects will, therefore, be its export performance.

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* The author wishes to thank Dorde Cedic and Ronald Oechsler for their assistance in preparing this paper, and Allen Lenz, whose contribution to the methodology formed the basis of this study.

[1] There are no doubt opportunities for China to expand hard currency earnings from tourism, foreign remittances, and business ventures in Hong Kong. This paper, however, addresses merchandise exports, which are likely to be the most significant single source of future foreign exchange earnings.

[2] Near-term being through 1980, and medium term extending into the early 1980's. When used throughout the paper, these terms will denote the same time frames.

II. Objectives and Methodology

This paper presents an analysis of China's hard currency export capabilities. The objectives are twofold: first, to contribute to an understanding of China's hard currency export capacity and therefore, to future levels of trade, and second, to provide data that may be useful to other researchers in performing their own analyses.

A basic assumption is that genuine growth in Chinese export capability, or change in its composition, must normally occur in relatively moderate stages. Examination of recent exports can, therefore, give an indication of the kinds of items and their likely export volumes in the years immediately ahead.

Export volumes, however, are not determined solely by ability to supply goods, but also by demand in importing countries. Analysis of China's hard currency exports using disaggregated data provides some indication of the world market demand for specific commodities, and hence, the potential effect of demand levels on export prospects.

This paper provides data covering recent exports of the People's Republic of China to 20 hard currency countries.[3] This group of 20 includes all the major industrialized Western countries plus a few countries in Asia, which by virtue of geographic proximity are significant export markets for the PRC.[4] Data presented in this paper was originally reported by each country to the United Nations and is based on the Standard International Trade Classification (SITC) [5] system outlined by the U.N. Latest data currently available cover imports from China through yearend 1976 by all countries except Malaysia,[6] whose imports have been estimated.

From these data, the following data tabulations are provided:

(1) *Table 1.*—At the one-digit level of detail, China's exports to The Twenty hard currency countries for individual years 1972–76, showing dollar value and composition.

(2) *Table 2.*—Disaggregated data at the two- and five-digit SITC levels. These data are ranked by descending 1976 total export value to The Twenty. The top 15 two-digit SITC categories are displayed, as are the top 50 five-digit categories,[7] along with their 1974 and 1975 values. The rank occupied by each commodity in 1975 is also included in both tables, to show the degree to which commodity composition of China's exports changed between the two years.

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[3] Hereafter, often referred to as The Twenty, countries included in the group are: Australia, Austria, Belgium/Luxembourg, Canada, Denmark, Federal Republic of Germany, France, Hong Kong, Indonesia, Italy, Japan, Malaysia, Netherlands, Norway, Singapore, Sweden, Switzerland, United Kingdom, and United States.

[4] It is noteworthy that unlike trade of other communist countries, China's trade has been dominated by trade with noncommunist partners.

[5] The terminology and data disaggregations used in this paper, i.e., one-digit SITC = section, two-digit SITC-division, five-digit SITC = item, follows the definitions stated in the "Standard International Trade Classification, Revised," Statistical Office of the United Nations, New York, 1961.

[6] Malaysian data was available from Malaysian Government sources in the publications, "Supplement: Preliminary Figures of External Trade for the Period January to December 1976," Department of Statistics, Malaysia. Only totals and one-digit disaggregations for yearend 1976 were given. The percentage change from 1975 to 1976 for each one-digit SITC group was applied to the 1975 value of all commodities comprising that group. The total was adjusted likewise, i.e., the percentage change in total Malaysian imports from the People's Republic of China was applied to the comparable 1975 value. For reasons of consistency, 1975 data used was from, "Supplement: Preliminary Figures of External Trade for the Period January to December, 1975," Department of Statistics, Malaysia.

[7] The SITC (1961) system defines and uses 56 two-digit product division classifications and 1,312 five-digit (unique level) item classifications. The list of commodities at the five-digit level may at times include four-digit categories if the most disaggregated level reported is the four-digit item. The attempt in this data presentation is to display the top 50 unique level export commodities.

(3) *Table 3.*—For each of the top 25 1976 five-digit exports to The Twenty, the share of each commodity absorbed by The Twenty importing countries individually.

The one-digit data display broadly distinguishes exports by disaggregating them into 10 categories. From these, it is possible to make some generalizations about the degree to which Chinese export capability is concentrated in raw materials, semiprocessed goods, and finished manufactures. The two-digit disaggregation provides an additional level of detail, where breakdowns are somewhat akin to industries.

The five-digit disaggregation is the finest level of detail available from United Nations data. Ranking the top 50 individual hard currency earning commodities is useful in assessing the diversity of the export composition. Five-digit item data can also be used to identify commodities that might be import sensitive and that could be subject to varying degrees of price fluctuation, depending upon world market conditions.

Lastly, showing the country destinations for the top five-digit commodities distinguishes market concentration, and highlights the degree of dependence a particular export commodity has on economic conditions in importing countries. Concentration of sales in only a few of The Twenty countries would tend to make export capabilities sensitive to economic conditions in the importing country and, conceivably, could also make sales dependent on political relations between China and a specific importing country. This type of export market shares presentation is particularly relevant to China, where many items are exported in substantial quantity to only a very few countries.

III. LIMITATIONS OF METHODOLOGY

There are always significant limitations on the use of historical data in predicting future trends. Even though the recent past may be a good indicator of the near to medium term, it has obvious faults. For example, while there is little likelihood, even for a planned economy, of very large year-to-year changes in the general composition of items that can be offered for export, importing countries' demands, particularly for crude materials, fuels, and semi-processed goods, may fluctuate. Thus, not only Chinese supply but world market conditions are important in projecting future exports, a factor which has been significantly relevant to many items in China's export structure.

Additionally, projections of future capabilities obviously cannot rely solely on historical data, but need to make use of available supporting information on conditions in the domestic economy, domestic policy changes, trends in economic relations with importing countries, special trade agreements, et cetera. Last, it is important to maintain a perspective on what effects the rising tide of protectionism among most of China's hard currency trading partners may have on China's near to medium term hard currency earning capability.

Beyond general problems concerning the use of historical data, the reader should be aware of limitations specific to data in this study. These are: (1) that Chinese hard currency exports to The Twenty countries in this paper do not represent total Chinese hard currency capability, (2) that data used herein has about an 18-month time lag, (3) that data is denoted only in terms of dollar value and not volume, and (4) that data is reported by most of The Twenty importing countries on a CIF (Cost, Insurance, Freight) basis, rather than on an FOB (Free on Board) basis. Each of these limitations is discussed in greater detail below.

Exports from the People's Republic of China to the sample of 20 countries used in this paper do not reflect total Chinese hard currency exports in any one year. The 20 countries comprising the sample were chosen because in all cases they import from the People's Republic of China on a hard currency basis. China's non-Communist trading partners in South Asia, the Near East, Africa, and Latin America, which are by and large LDC's, were excluded from the sample. These countries do not necessarily conduct their trade with China in hard currencies; while some exchanges may go beyond bilaterial clearing arrangements, there is not sufficient data for purpose of analysis in this paper to determine the value of this hard currency trade. Similarly, Communist countries are excluded from our sample, since as a rule China's trade with these countries is conducted primarily through bilateral clearing accounts and not on a hard currency basis.

Using data estimates of China's total exports to all non-Communist countries between 1971 and 1976,[8] exports to the 20 countries comprised about 80 percent of that total. Furthermore, to the extent that some trade with other non-Communist countries may be conducted through bilateral clearing accounts, exports to the 20 countries would account for an even larger share of China's non-Communist exports.

An additional argument supporting use of the 20 countries as a proxy for estimating China's future hard currency earnings capabilities lies in the fact that the 20 countries used in this paper probably represent the largest potential for future expansion of hard currency earnings. The group includes not only the major part of the Industrialized West but also the largest Asian markets for Chinese goods. Other non-Communist countries, generally LDC's, not included in the 20 countries probably are not major potential hard currency export markets since they are generally facing debt and trade deficit problems of their own.

The second limitation of data in this paper is that the most recent data available, disaggregated to the detail presented, covers Chinese exports to the 20 countries only through yearend 1976.[9] Similar 1977 data will not be available until mid-1978.[10] In making analyses of future Chinese export capabilities employing the technique used herein, there will inevitably be a lag of at least 6 months between the period covered by the data and its availability.

Another limitation of the data is that it has been available to this author only in dollar values and not in volume terms. Hence, it does not provide information concerning volume trends in exports, which is often significant to an understanding of basic export capabilities. For the purposes of this paper—an examination of China's ability to earn hard currency—this limitation is somewhat secondary, since our primary concern is with actual dollar value hard currency earnings from whatever source they are derived, that is, volume or price increases.

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[8] Estimates are found in: *China: International Trade, 1976–77*, Central Intelligence Agency, National Foreign Assessment Center. Publication No. ER 77-10674, November 1977.

[9] At the time of writing, 1976 data was actually available for only nineteen of the twenty countries. Malaysian data had to be estimated. See footnote 5.

[10] This paper will be updated as soon as 1977 data are available. The update should be completed by December 1978, and may be obtained from the author, c/o Office of East-West Policy and Planning, Bureau of East-West Trade, Industry and Trade Administration, U.S. Department of Commerce, Washington, D.C. 20230.

Finally, most of the 20 countries, when reporting their imports from other countries, have done so on a CIF (cost, insurance, freight) basis.[11] This has relatively minor consequence when analyzing China's exports to the 20 countries, since the greater percentage of these exports are shipped to countries within close geographic proximity. In comparing Chinese exports on a CIF basis to data adjusted to FOB (free on board),[12] total export earnings recorded CIF have been judged to be inflated by about 6 percent. This percentage, of course, varies considerably among destinations and commodities. For example, the sum total of China's exports to Sweden, when reported CIF are judged as 16 percent higher than if they had been reported FOB. The same comparison for Hong Kong yields virtually no difference between the two reporting methods. Likewise, different commodities shipped to the same country will also incur varying charges that will result in differences between CIF and FOB reports.

IV. ANALYSIS OF EXPORT COMPOSITION

Having presented the analytical framework and its limitations, the commodity composition of China's hard currency exports to the 20 countries can now be examined. The first part of the analysis provides some general highlights about China's hard currency export trade—its broad makeup, major importing countries—and a limited comparison of Chinese export composition and volume with that of other Communist countries. Following this overview, a systematic examination of the four major categories of China's exports (food, textile fibers/fabrics, petroleum, finished manufactures) is provided. Analyses are based on the top two-digit SITC product divisions that comprise each of the major categories and also include an examination of the top export items at the five-digit SITC level of disaggregation.

A. Data Highlights

China's exports to the 20 countries, disaggregated at the one-digit SITC level of detail, appear in Table 1. From this table we note the following:

> At $5 billion, 1976 exports to the 20 countries were about 140 percent greater than the 1972 level.
>
> At nearly $3 billion, China's exports of primary products (SITC 0–4) accounted for 58 percent of the total and were the largest group of commodities exported to the 20 countries in 1976. Nearly one-half of these exports were food and live animal items (SITC 0).
>
> Exports of intermediate products (SITC 5–6) were the next largest group, and at nearly $1.4 billion contributed 28 percent

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[11] Australia, Canada, and the United States report their imports FOB (Free On Board).

[12] Aggregated data adjusted to FOB can be found in: *China: International Trade, 1976–77*, Central Intelligence Agency, National Foreign Assessment Center. Publication No. ER 77-10674, November, 1977. Adjustments in this publication are, however, only judgmental and are not based on empirical analysis.

to total 1976 hard currency earnings from the 20 countries. Over one-half of intermediate goods exports were items of textile cloth.

Finished manufactured goods were the smallest group of products exported by the PRC; at $700 million, they comprised only 14 percent of hard currency exports to the 20 countries. In addition to clothing, the finished manufactures group included a wide variety of miscellaneous manufactures.

The composition of China's exports, aggregated into primary products, intermediate goods, and finished manufactures, has remained relatively the same since 1972. In 1972, primary products accounted for 57 percent of total exports as opposed to 58 percent in 1976, intermediate goods for 30 percent against 29 percent in 1976, and finished manufactures for 13 percent rather than 14 percent in 1976.

Among the three product groups, growth between 1972 and 1976 was most rapid for finished manufactures (157 percent) but was only somewhat faster than that of primary products (143 percent). The slowest growth rate was recorded by exports of intermediate goods.

Among the one-digit SITC disaggregations, exports of mineral fuels (SITC 3) showed a spectacular increase, rising from earnings of $12 million in 1972 to $662 million in 1976. This of course is explained by oil export increases, which came on stream in 1974.

TABLE 1.—PEOPLE'S REPUBLIC OF CHINA: EXPORTS TO 20 HARD-CURRENCY COUNTRIES,[1] 1972–76

[Amounts rounded to millions of U.S. dollars]

	1972		1973		1974		1975		1976	
SITC—Description	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent
0—Food and live animals	650	31.3	981	28.5	1,271	29.7	1,398	29.5	1,339	27.0
1—Beverages and tobacco	26	1.3	34	1.0	43	1.0	49	1.0	57	1.2
2—Crude materials, inedible, except fuels	469	22.3	713	20.7	631	14.7	647	13.6	762	15.4
3—Mineral fuels lubricants and related materials	12	.6	50	1.5	469	11.0	826	17.4	662	13.4
4—Animal and vegetable oils and fats	19	.9	24	.7	47	1.1	33	.7	34	.7
5—Chemicals	108	5.2	174	5.1	290	6.7	241	5.1	261	5.3
6—Manufactured goods classified chiefly by material	517	24.9	947	27.5	922	21.5	975	20.5	1,117	22.5
7—Machinery and transport equipment	32	1.5	54	1.6	75	1.8	81	1.7	105	2.1
8—Miscellaneous manufactured articles	237	11.4	460	13.4	513	12.0	477	10.1	586	11.8
9—Commodities not elsewhere classified	7	.3	7	.2	22	.5	20	.4	31	.6
Total	2,077	100.0	3,444	100.0	4,283	100.0	4,747	100.0	4,954	100.0
0–4—Primary products	1,176	56.6	1,802	52.3	2,461	57.5	2,953	62.2	2,854	57.6
5–6—Intermediate goods	625	30.1	1,121	32.5	1,212	28.3	1,216	25.6	1,378	27.8
7–8—Finished manufactured	269	13.0	514	14.9	588	13.7	558	11.8	691	13.9

[1] Hard-currency countries cited are: Canada, United States, Japan, Belgium, Luxembourg, France, Federal Republic of Germany, Italy, Netherlands, Austria, Norway, Sweden, Switzerland, United Kingdom, Denmark, Hong Kong, Malaysia, Indonesia, Australia, Singapore.

Table 2 provides the top 15 two-digit product divisions exported in 1976 and, at the greatest level of detail available from the United Nations data, the top 50 items exported by the PRC to The Twenty as a group. Examination of these data leads to The following observations:

China's hard currency export capabilities are relatively diversified, with the top 50 items accounting for only 64 percent of trade. There was, however, a relatively large concentration of exports among the top 10 items, which comprised one-third of total hard-currency earnings from The Twenty. After the top 10, all the remaining items in the top 50 ranking individually contributed on the average of 1 percent to total hard currency earnings.

The commodity composition of the top 50 items exported to The Twenty varied only slightly over the 3 years, 1974 to 1976. In 1974, 63.1 percent of total hard currency was earned by the top 50; in 1976, this percentage had risen slightly to 63.6 percent. Because of a near doubling of crude petroleum exports in 1975, the top 50 items in that year accounted for 67 percent of total hard-currency earnings from The Twenty.

At the two-digit SITC level of disaggregation, textile fabrics (SITC 65) contributed the largest share to hard-currency earnings in 1976. Except for 1975, when oil exports rose dramatically, textile fabrics have been the most important hard currency earning commodities at the two-digit level.

Petroleum and petroleum products (SITC 33) ranked as the second largest hard currency export earner in both 1976 and 1974, and the largest in 1975. Furthermore, earnings from petroleum exports as a percentage share of total hard currency earnings has been moving upward. In 1974, petroleum and its products accounted for 10.6 percent of earnings; 2 years later this share had risen to 13.1 percent.

The largest export item at the five-digit level of detail was crude petroleum (SITC 33101). It alone earned nearly 12 percent of all hard currency from exports to The Twenty in 1976.

Among food items, the most important have been swine, rice, and seafood (SITC 0013, 0422, and 0313). In 1976, these items individually were the second, fourth, and seventh largest export earners among the top 50 shown in table 2.

The most important manufactured item exported by the PRC was basketwork (SITC 89922), followed by a wide variety of clothing items. Besides basketwork and clothing, the remaining manufactured item appearing on the top 50 list was footwear (SITC 85102).

TABLE 2.—PEOPLE'S REPUBLIC OF CHINA: 1976 TOP EXPORTS TO 20 HARD-CURRENCY COUNTRIES

[In thousands of U.S. dollars]

SITC	Commodity	1976 rank	1976 value	Percent of total	Cumulative percent	1975 rank	1975 value	Percent of Total	Cumulative percent	1974 value	Percent of Total	Cumulative percent
	1976 RANK ORDER OF PRODUCT DIVISIONS (2-DIGIT SITC)											
65	Textile yarn, fabrics, made-up articles	(1)	724,031	14.6		(2)	617,720	13.0		544,305	12.7	
33	Petroleum and petroleum products	(2)	649,283	13.1		(1)	807,923	17.0		455,042	10.6	
05	Fruit and vegetables	(3)	343,709	6.9		(4)	307,905	6.5		283,441	6.6	
26	Textile fibers, not manufactured into yarn	(4)	285,584	5.8		(5)	220,956	4.7		193,110	4.5	
84	Clothing	(5)	260,665	5.3	45.7	(7)	202,013	4.3	45.4	238,851	5.6	40.0
29	Crude animal and vegetable materials	(6)	245,250	5.0		(9)	176,193	3.7		195,836	4.6	
00	Live animals	(7)	222,121	4.5		(6)	209,995	4.4		192,394	4.5	
89	Miscellaneous manufactured articles	(8)	216,786	4.4		(8)	180,023	3.8		190,960	4.5	
04	Cereals and cereal preparations	(9)	188,256	3.8		(3)	338,385	7.1		312,262	7.3	
03	Fish and fish preparations	(10)	183,566	3.7	67.0	(11)	157,593	3.3	67.8	165,319	3.9	64.7
01	Meat and meat preparations	(11)	173,486	3.5		(10)	168,258	3.5		143,303	3.3	
66	Nonmetallic mineral manufactures	(12)	112,867	2.3		(13)	101,957	2.1		108,647	2.5	
22	Oil-seeds, oil-nuts, and oil kernels	(13)	85,049	1.7		(12)	121,771	2.6		122,194	2.9	
07	Coffee, tea, cocoa, spices	(14)	78,605	1.6		(19)	58,213	1.2		48,326	1.1	
51	Chemical elements and compounds	(15)	71,493	1.4	77.5	(15)	73,434	1.5	78.8	75,788	1.8	76.3
	Top 15 total		3,840,751				3,742,339			3,269,778		
	Total exports to 20 countries		4,954,363				4,746,577			4,282,935		
	Top 15 as percent of total exports to the 20		77.5				78.8			76.3		
	1976 RANK ORDER OF ITEMS (5 DIGIT SITC)											
33101	Crude petroleum	(1)	568,063	11.5		(1)	741,157	15.6		413,277	9.6	
0013	Swine	(2)	174,089	3.5		(3)	164,238	3.5		148,597	3.5	
65691	Linens and other furnishing articles	(3)	138,181	2.8		(5)	115,562	2.4		98,557	2.3	
0422	Rice, glazed or polished	(4)	135,882	2.7		(2)	285,611	6.0		269,437	6.3	
65213	Cotton fabrics, unbleached, woven, nec	(5)	129,267	2.6	23.1	(4)	122,261	2.6	30.1	109,632	2.6	24.3
2613	Raw silk	(6)	128,168	2.6		(6)	101,578	2.1		135,560	3.2	
0313	Crustacea and mollusks, fresh, chilled, frozen	(7)	95,339	1.9		(8)	86,973	1.8		77,439	1.8	
65229	Cotton fabrics, bleached, woven, nec	(8)	92,304	1.9		(11)	69,037	1.5		74,777	1.7	
2924	Plants, seeds, flowers, and plant parts	(9)	84,353	1.7		(12)	65,383	1.4		66,406	1.6	
89922	Basketwork, wickerwork	(10)	79,677	1.6	32.8	(13)	58,277	1.2	38.1	46,823	1.1	33.6
65311	Silk fabrics, woven	(11)	63,272	1.3		(9)	72,691	1.5		47,067	1.1	
0250	Eggs	(12)	60,374	1.2		(14)	58,199	1.2		57,782	1.3	

TABLE 2.—PEOPLE'S REPUBLIC OF CHINA: 1976 TOP EXPORTS TO 20 HARD-CURRENCY COUNTRIES—Continued

[In thousands of U.S. dollars]

SITC	Commodity	1976 rank	1976 value	Percent of total	Cumulative percent	1975 rank	1975 value	Percent of Total	Cumulative percent	1974 value	Percent of Total	Cumulative percent
0311	Fish, fresh, chilled, frozen	(13)	58,829	1.2		(16)	51,754	1.1		48,963	1.1	
05552	Vegetables, preserved, n.e.c	(14)	53,710	1.1		(15)	52,515	1.1		43,157	1.0	
6130	Fur skins, tanned or dressed	(15)	50,955	1.0	38.6	(22)	38,698	.8	43.9	37,463	.9	39.1
84111	Men's and boys' outer garments, not knitted	(16)	49,661	1.0		(27)	33,411	.7		42,478	1.0	
2623	Fine animal hair, nonwool	(17)	49,407	1.0		(35)	25,674	.5		26,384	.6	
05172	Edible nuts, fresh or dried, n.e.c	(18)	49,208	1.0		(19)	41,733	.9		35,521	.8	
2214	Soybeans	(19)	48,612	1.0		(7)	87,692	1.8		90,146	2.1	
29193	Guts, bladders, and stomachs of animals	(20)	47,276	1.0	43.5	(21)	40,708	.9	48.7	36,774	.9	44.5
2631	Raw cotton, other than linters	(21)	45,847	.9		(18)	44,100	.9		544	0	
59964	Rosin and resin acids, etc	(22)	45,655	.9		(17)	45,770	1.0		72,827	1.7	
29192	Bristles and brush-making hair	(23)	42,282	.9		(43)	22,075	.5		41,246	1.0	
0113	Meat of swine, fresh, chilled, frozen	(24)	42,223	.9		(20)	41,656	.9		36,685	.9	
29196	Birds' feathers	(25)	40,697	.8	47.9	(56)	18,248	.4	52.4	22,044	.5	48.6
6664	Porcelain or china household ware	(26)	39,223	.8		(23)	38,409	.8		32,186	.8	
0542	Beans, peas, lentils, other vegetables	(27)	37,504	.8		(59)	17,486	.4		20,867	.5	
0551	Vegetables, dehydrated	(28)	37,146	.7		(30)	28,839	.6		30,560	.7	
6871	Tin and tin alloys, unwrought	(29)	36,662	.7		(10)	72,006	1.5		48,816	1.1	
0741	Tea	(30)	36,457	.7	51.7	(32)	27,215	.6	56.2	22,184	.5	52.2
6575	Carpets, carpeting, rugs	(31)	35,778	.7		(37)	25,204	.5		19,575	.5	
3323	Distillate fuels	(32)	34,043	.7		(25)	36,981	.8		16,954	.4	
84113	Men's and boys' undergarments	(33)	33,362	.7		(39)	24,318	.5		30,086	.7	
6513	Cotton yarn and thread, unbleached	(34)	33,059	.7		(42)	22,262	.5		22,456	.5	
84143	Undergarments, knitted or crocheted	(35)	33,020	.7	55.1	(29)	28,902	.6	59.1	30,176	.7	54.9
0545	Fresh vegetables, n.e.c	(36)	32,549	.7		(26)	35,951	.8		32,289	.8	
01189	Meat and edible offals	(37)	31,899	.6		(24)	38,172	.8		26,998	.6	
0014	Poultry, live	(38)	30,745	.6		(31)	27,462	.6		25,732	.6	
28392	Tungsten ores and concentrates	(39)	30,013	.6		(48)	20,016	.4		19,775	.5	
5713	Pyrotechnical articles	(40)	29,604	.6	58.2	(53)	18,846	.4	62.1	13,739	.3	57.7
1210	Tobacco, unmanufactured	(41)	27,560	.6		(46)	21,176	.4		18,693	.4	
84112	Women's, girls', infants' outer garments	(42)	27,321	.6		(44)	21,630	.5		36,308	.8	
0539	Fruits and nuts, prepared or preserved	(43)	27,143	.5		(41)	22,863	.5		20,397	.5	
84144	Outer garments, knitted, crocheted	(44)	27,139	.5		(40)	23,672	.5		28,952	.7	
2211	Peanuts, green	(45)	27,084	.5	61.0	(38)	24,536	.5	64.5	23,433	.5	60.7
85102	Footwear with leather soles, n.e.c	(46)	26,594	.5		(36)	25,307	.5		21,232	.5	
0116	Edible offals of animals	(47)	26,253	.5		(45)	21,235	.4		18,282	.4	
0138	Meat, prepared or preserved, n.e.c	(48)	25,711	.5		(34)	26,061	.5		23,970	.6	
5417	Medicaments	(49)	25,462	.5		(33)	26,784	.6		22,093	.5	
8413	Leather apparel and clothing accessories	(50)	24,526	.5	63.6	(52)	18,912	.4	67.0	18,915	.4	63.1
	Top 50 total		3,149,188				3,179,246			2,704,254		
	Total exports to 20 countries		4,954,363				4,746,577			4,282,935		
	Top 50 as percent of total exports to the 20		63.6				67.0			63.1		

Looking to Table 3, which shows the percent share of each of the top 25 1976 export items absorbed by each of The Twenty individually, we note the following:

Hong Kong was China's largest market for exports to The Twenty,[13] with Japan a close second. Amoug countries outside the Asia basin, the Federal Republic of Germany was the largest importer of China's goods. Other important Western markets were the United States and France.

One hundred percent of crude oil, the largest single export item, was absorbed by Japan.

One hundred percent of swine, the second largest export item went to Hong Kong.

The major portion of the top food items exports were absorbed by Hong Kong and Japan. Interestingly, over one-half of processed swine meat was imported by France, which in recent years has been a strong market for this commidity.

Various Western countries were the most important markets for a number of China's top export items. Italy absorbed the largest portion of silk cloth exports, the FRG imported the largest amount of China's preserved vegetables, France was the most important market for fur skins and processed swine meat, Canada for men's and boys' undergarments, and the United States for birds' feathers and down.

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[13] Probably about 30 percent of Hong Kong's imports from the PRC, however, are reexported.

TABLE 3.—PEOPLE'S REPUBLIC OF CHINA; PERCENT SHARES OF TOP 25 1976 EXPORTS TO 20 HARD-CURRENCY COUNTRIES TAKEN BY EACH COUNTRY INDIVIDUALLY

				Percent shares taken by importing countries									
SITC	PRC Export item	1976 Rank	Dollar value (thousands)	Canada	United States	Japan	Belgium/Luxembourg	France	Federel Repubilc of Germany	Italy	Netherlands	Austria	Norway
33101	Crude petroleum	1	568,063			100.0							
0013	Swine	2	174,089										
65691	Linens and other furnishings, articles	3	138,181	8.2	2.5	9.4	0.5	1.9	2.4	1.9	0.1	0.1	0.4
0422	Rice, glazed or polished	4	135,882	0	0	.8		0			0	.2	.1
65213	Cotton fabrics, unbleached, woven	5	129,267	2.5		14.7	.3	9.4	2.3	1.1	11.5		
2613	Raw silk	6	128,186		3.1	36.8		8.3	2.0	35.8			
0313	Crustacea, mollusks, fresh, chilled	7	95,339	.6	4.4	53.2	.6	1.0	2.7	.4	2.6	0	0
65229	Cotton fabrics, bleached, woven	8	92,304	3.6		1.8	0	.7	.6	0	0	.1	
2924	Plants, seeds, flowers and plant parts	9	84,353	.1	1.7	9.7	0	.3	1.1	1.3		0	
89922	Basketwork, wickerwork	10	79,677	.9	12.7	13.5	2.4	8.3	13.8	7.9	5.2	.7	.3
65311	Silk fabrics, woven	11	63,272	.3	2.4		0	14.8	9.9	31.5	0	.3	0
0250	Eggs	12	60,374	.1	.6	15.5		0	.1	.2	.4	1.2	
0311	Fish, fresh, chilled, frozen	13	58,829	.1	1.7	11.5	0	.2	.1	.3	.1		
05552	Vegetables, preserved	14	53,710	4.2		8.2	2.3	.2	36.3	0	9.2	.3	.1
6130	Fur skins, tanned or dressed	15	50,955	1.0	0	20.1	.7	30.7	9.4	3.3	.4	0	
84111	Mens and boys outer garments, unknitted	16	49,661	32.2	4.0	19.8	.1	2.6	3.9	.4	1.2	.1	.3
2623	Fine animal hair, other than wool	17	49,407		6.4	31.4	10.4	5.0	6.6	10.8	1.7	0	
05172	Edible nuts, fresh or dried	18	49,208	5.8	.7	58.8		.1	3.5	.2	.4	.3	
2214	Soybeans	19	48,612			75.3		0	0			0	
29193	Guts, bladders, and stomachs of animals	20	47,276	0	.3	.6	2.1	8.1	58.1	3.1	13.3		.9
2631	Raw cotton, other than linters	21	45,847			16.4							
59964	Rosin and resin acids, etc	22	45,655	.1	1.3	46.5	1.7	4.6	14.2	7.5	6.1	1.4	.2
29192	Bristles and brushmaking hair	23	42,282	1.1	19.1	11.4	.9	9.5	11.0	5.8	7.9	.5	.1
0113	Meat of swine, fresh, chilled, frozen	24	42,223					52.9		14.2	0	.1	
29196	Birds' feathers	25	40,697	.1	35.0	14.0	0	1.2	27.5	0	2.2	3.5	1.0
	Top 25 total		2,373,331										
	Total exports to 20 hard-currency countries		4,954,363	1.8	4.1	27.7	1.1	3.9	5.5	3.1	1.8	.4	.2

TABLE 3.—PEOPLE'S REPUBLIC OF CHINA; PERCENT SHARES OF TOP 25 1976 EXPORTS TO 20 HARD-CURRENCY COUNTRIES TAKEN BY EACH COUNTRY INDIVIDUALLY—Continued

SITC	PRC Export item	1976 rank	Dollar value (thousands)	Percent shares taken by importing countries								
				Sweden	Switzerland	United Kingdom	Denmark	Hong Kong	Malaysia	Indonesia	Australia	Singapore
33101	Crude petroleum	1	568,063									
0013	Swine	2	174,089					100.0				
65691	Linens and other furnishings, articles	3	138,181	0.7	0.5	0.4	0.7	52.2	0.5	1.7	5.0	10.4
0422	Rice, glazed or polished	4	135,882	.6	0	.1	0	46.8	24.7	25.6	0	1.4
65213	Cotton fabrics, unbleached, woven	5	129,267	1.9	2.5	8.0	2.0	40.0	.1	.1	1.4	2.2
2613	Raw silk	6	128,168		2.4	1.6		9.9		.2		0
0313	Custacea, mollusks, fresh, chilled	7	95,339	.8	.4	2.1	.1	25.4	.2	0	4.7	.7
65229	Cotton fabrics, bleached, woven	8	92,304	.9		.2	.1	42.3	6.0	.7	24.0	18.7
2924	Plants, seeds, flowers and plant parts	9	84,353	0	.1	.1	0	67.8	6.8	.3	.1	10.7
89922	Basketwork, wickerwork	10	79,677	2.1	1.1	6.0	1.8	20.5	.3	0	2.1	.3
65311	Silk fabrics, woven	11	63,272	.3	5.8	4.9	.5	25.8	0		1.7	1.8
0250	Eggs	12	60,374		0	0		77.8	1.4	0		2.8
0311	Fish, fresh, chilled, frozen	13	58,829	0		.2		85.1	.1		.2	.3
05552	Vegetables, preserved	14	53,710	11.7	3.9	.5	.7	9.6	2.9	.4	1.8	7.7
6130	Fur skins, tanned or dressed	15	50,955	.1	.4	12.8	.1	20.7			.2	0
84111	Mens and boys outer garments, unknitted	16	49,661	2.1	1.8	.1	1.1	24.2	.3	.2	4.8	.8
2623	Fine animal hair, other than wool	17	49,407		.4	25.2		2.1				
05172	Edible nuts, fresh or dried	18	49,208	0		7.1		18.6	.4	0	.6	3.6
2214	Soybeans	19	48,612		0		0	11.5	7.1	.9	0	5.2
29193	Guts, bladders, and stomachs of animals	20	47,276	.2	5.6		0	1.3	.2			.2
2631	Raw cotton, other than linters	21	45,847	.2	.3			74.1	.1	.8	1.7	6.5
59964	Rosin and resin acids, etc	22	45,655	.3	.2	10.8	.1		0		5.0	
29192	Bristles and brushmaking hair	23	42,282	1.4	1.1	25.2	.3	.4	.1	.1	4.1	0
0113	Meat of swine, fresh, chilled, frozen	24	42,223					32.8		0		
29196	Birds' feathers	25	40,697		2.5	5.5	5.8	1.6	0		0	
	Top 25 total		2,373,331									
	Total exports to 20 hard-currency countries		4,954,363	1.0	.7	3.1	.5	32.2	2.8	2.7	2.0	5.4

Note: Zero—small amount, rounding to zero percent.

In comparing China's export structure to that of East European Communist countries, we note the following:

In looking at similar shares of hard-currency exports covered by data for China on the one hand and the U.S.S.R. on the other, China's 1976 exports were 57 percent of those of the Soviet Union, but 50 percent greater than Poland's. China's hard-currency exports were thus the second largest among the Communist countries.

The composition of China's exports as differentiated among primary products, intermediate goods, and finished manufactures was somewhat similar to that of the U.S.S.R., in that primary products accounted for the largest share of exports from both countries. In the case of China, however, exports of food products were the major primary products group exported, whereas for the Soviet Union, oil was overwhelmingly the most important primary product.

Between 1972 and 1976, total Chinese hard currency exports to The Twenty increased about 140 percent; in the same period, the U.S.S.R.'s increased 148 percent, Poland's 138 percent.

Food products exports were the most significant hard-currency earning commodities for China. Placing these into perspective, we note that in 1976, food products exported by China amounted to about 75 percent of total food products exported to hard currency destinations that year by the U.S.S.R. and Eastern Europe as a whole.

In value terms, China's exports of finished manufactures were nearly twice those of the U.S.S.R. and about equal in value to those of Poland, which in 1976 was the largest exporter of finished manufactured goods among the East European Communist countries.

Exports of crude petroleum, the largest single hard currency earning commodity for both the U.S.S.R. and China, accounted for 16 percent of Soviet hard currency earnings from exports to the Industrialized West in 1976, compared to 12 percent of China's earnings from exports to The Twenty.

Looking to petroleum and petroleum products; (e.g. distillate fuels, residual fuel oils, gasoline), however, the disparity between their importance of hard currency earning capacity for the U.S.S.R. and China is significant. Soviet exports of petroleum products added 28 percent to Soviet hard currency earnings in 1976, raising the total share contributed by petroleum and petroleum products to U.S.S.R.'s 1976 hard currency earnings to 44 percent. China's exports of petroleum products, however, contributed less than a mere two percent additional to 1976 hard currency earnings from The Twenty, raising the total share contributed by petroleum and petroleum products to China's 1976 hard currency earnings to just over 13 percent. Clearly petroleum products were far more important to hard currency earnings capacity for the U.S.S.R. than for China.

Analysis of data in Tables 1 through 3 leads to several observations:

China's near to medium term export capabilities will likely be dominated by primary products, with some increases possibly evidenced in exports of manufactured goods.

Among primary products, foods and petroleum will continue to dominate the export composition, with crude petroleum exports likely to be the single largest hard currency earning commodity.

Exports of textile fibers and fabrics will continue to contribute significant amounts of hard currency to China's total earnings from The Twenty.

Japan and Hong Kong are likely to remain China's most important trading partners. Together these two countries will probably continue to absorb about one-half of China's hard currency exports.

B. Analysis of Major Export Categories

1. FOOD PRODUCTS

In 1976, earnings from food exports (SITC 0) amounted to 27 percent of total hard currency earned from merchandise exports to The Twenty countries. From Table 2, we see the following food products as the major sources of this hard currency: fruits and vegetables (SITC 05), live animals (SITC 00), cereals (SITC 04), and fish (SITC 03). Together these accounted for 70 percent of the value of food products exports to The Twenty.

Fruits and vegetables (SITC 05) was the largest food export group in 1976. As the third largest among the two-digit SITC rankings, it accounted for 7 percent of hard currency earned from total exports to The Twenty. This commodity group is comprised mainly of items that have been traditional Chinese exports: dried beans, peas, and lentils, edible nuts, dehydrated or otherwise preserved vegetables, preserved fruit, and fresh vegetables. Traditional markets have been primarily Hong Kong and Japan, and to a lesser extent, Singapore. Since at least the early seventies, these three countries have together absorbed on the average of two-thirds of all Chinese fruit and vegetable exports to The Twenty. Some Western countries have, however, imported significant shares of specific items within the group; for example, in recent years, West Germany has been the largest importer of China's preserved vegetables exports and a substantial importer of preserved fruits and nuts.

In 1976, exports of the major commodities in the fruits and vegetables category increased somewhat over 1975 levels, though the increases were probably from higher prices rather than larger volume exports. The only exception to increased earnings in 1976 over 1975 was earnings from shipments of fresh vegetables, which posted a small decline. It is possible that transportation bottlenecks, resulting from the July earthquake, caused slightly lower deliveries.

After fruits and vegetables, *live animals* was the second largest food export group. Swine (SITC 0013) and poultry (SITC 0014) together made up the major part of this category which has contributed 4 to 5 percent to hard currency earnings in recent years. It is noteworthy that swine was the second largest single commodity (after crude petroleum) exported to The Twenty in 1976, and alone contributed 4 percent to hard currencies earned from those countries. One hundred percent of swine and poultry exports have traditionally been shipped to Hong Kong, whose food economy is highly dependent on Chinese products.

Although exports of live animals have been increasing over the years, the rate of increase slowed considerably at mid-decade. Future exports will probably continue to rise at modest rates, maintaining their importance as top hard currency export commodities, though the rate of increase may be slow if domestic demand pressures cut into export supply availabilities.

Cereals and cereal preparations (SITC 04) was China's third ranking food products export in 1976. At $188 million, earnings contributed nearly 4 percent to the total value of hard currency exports to the 20 countries. The 1976 earnings represented a dramatic decline from the level of 1975, when cereals exports valued at $338 million, contributed 7 percent to that year's hard currency earnings.

In 1976, rice (SITC 0422), the major item of the cereals group, was fourth largest among all export items, ranking only behind crude petroleum, swine and linens. Rice exports alone contributed nearly 3 percent to hard currency earnings from The Twenty. Major markets for Chinese rice were Hong Kong, Indonesia, and Malaysia, which together absorbed 97 percent of the value exported.

The dramatic 53 percent decline in Chinese rice exports in 1976 was spread among all major importers. This poor 1976 export performance can probably be traced to production growth too slow to sustain domestic needs and exports. Total grain production in 1976 was a meager 1 to 2 percent above 1975 levels, just keeping pace with population growth. Although output of other grains increased, rice output showed a slight downturn. Adverse weather conditions in various parts of China during crucial planting and growing periods had a negative effect on what at first had appeared to be a good agricultural year. Weather conditions specifically affected the fall rice crop which could not be harvested at the normal time. State procurement levels, an indication of the amount of grain an area can spare after meeting local needs, were not announced at the end of 1976; this stands in contrast to official procurement announcements after the harvests of the previous 2 years.

Although 1977 data are not yet available, given that that year's crop yields were about the same as in 1976, it appears that the level of rice exports will not be much greater than in 1976. Future hard currency earnings from exports of rice will, however, remain important, though it is unlikely that they can be expanded significantly. Although world market demand and price may be firm, supplies may not be available in large enough quantities to take advantage of positive market situations—a condition not likely to improve in the near term, given the slow growth in agricultural production and increasing domestic needs.

Fish and fish preparations (SITC 03), the remaining important food export category, has been contributing 3 to 4 percent to total hard currency earnings from exports to the 20 countries. Two items, ranking among the top 50 commodity exports, comprised the major part of the fish group: crustacea/mollusks (SITC 0313) and fish (SITC 0311). Japan and Hong Kong are China's largest markets for fish exports; together they absorbed over 90 percent of fish shipped to the 20 countries.

Based on past trends, it can be expected that hard currency earnings from food products exports will continue, for the foreseeable future, to comprise at least one-fourth of total hard currency earned from sales to the 20 countries. Increases in dollar value earnings, however, will be only moderate, given the difficulty in raising agricultural production levels, and expanding domestic demand which may absorb even larger shares of food production if the Hua leadership makes good on its commitment to upgrade the standard of living.

2. TEXTILES: FABRICS AND FIBERS

After food, China's next major hard currency earning category was textiles. This section examines past export performance and future earning prospects for the top two groups which have accounted for the major part of textile exports. These are textile yarn, fabrics (SITC 65) and textile fibers (SITC 26).

Textile yarn, fabrics (SITC 65) was the largest two-digit group among all exports from the People's Republic of China in 1976. Traditionally, these exports, made up primarily of fabrics, have contributed sizeable amounts to China's hard currency account. Since at least 1974, about one-third of textile manufactures have been cotton cloth (SITC 65213 and 65229); another 20 percent have been fabricated linens (SITC 65691), and another 10 percent were silk fabrics (SITC 65311). Together these accounted for nearly 65 percent of textile yarn, fabrics group (note that these exclude clothing, which is classified as a finished manufactured item). The remainder of the fabrics group was made up of an assortment of less significant commodities.

China's markets for these goods (see Table 3) have been changing somewhat in recent years, particularly since 1974. Hong Kong has increasingly become a more important customer, while Japan, which had been the prime market prior to 1974, has been cutting back on its purchases. Hong Kong's rising market share has been based on expanded cotton cloth imports; Japan's import decline has stemmed from lower purchases of silk fabric and cotton linens.

Prospects for continued increases in hard currency earnings from fabric exports depend on several factors. Supplies of cotton cloth and fabricated linens available for export may at least in part be affected by cotton production levels and the amount of raw cotton that China will need to import, at what will probably be higher world market prices. Chinese exports will also be affected by the degree to which China is able to hold down domestic cotton consumption, and by the extent of China's success in attempting to shift production of fabrics away from pure cotton to blends of cotton and man-made fibers.

Future increases in earnings from silk fabric exports will also be limited by Japanese unwillingness to import silk. In the past, Japan had absorbed about 60 percent of China's silk fabric exports. Apparently, Japanese domestic fabric weavers are now unable to match Chinese prices and are thus putting strong pressures on the government to cut silk imports from China. The 33 percent drop in dollar value sales between 1975 and 1976 may be further aggravated in 1977 as pressures from domestic weavers continue.

Increases in future Chinese hard currency earnings from fabric exports to Western markets can also be seen as limited. In 1974, one-third of cotton fabric exports to our group of 20 countries went to four Western markets: United States, Britain, France, Netherlands. In 1976 the percentage share decreased to one-fourth. In an atmosphere of rising protectionism, particularly within the textile industry, it is doubtful that China will be able to escape the effects of Western import restrictions that are already dampening export growth in virtually all textile-exporting countries.

Textile fibers (SITC 26) exports ranked next among textile products exported by the People's Republic of China, and were large enough that they ranked fourth, following textile fabrics, petroleum, and fruits/vegetables, among all product groups exported in 1976. Commodities in this group included raw silk (SITC 2613), accounting for 45 percent of the group, fine animal hair (SITC 2623) adding another 17 percent, and raw cotton (SITC 2631) contributing 16 percent. Together these three items accounted for nearly 80 percent of textile fiber exports to the 20 hard currency countries.

After dramatic percentage increases in the value of textile fibers exported in 1972 (86 percent growth) and 1973 (73 percent growth), 1974 exports declined nearly 50 percent from 1973 levels. What had been the second largest export earning group in 1973 dropped to seventh rank in 1974. A modest 15-percent recovery in all textile fiber exports was registered in 1975 and a 30-percent growth in 1976, but these increases were not sufficient to restore earnings to 1973 peak levels.

The factor behind the dramatic increase and subsequent falloff in textile fiber exports was fluctuation in Japanese demand for raw silk, a commodity which makes up a significant portion of the textile fibers group. Prior to 1972, raw silk imports were restricted to protect the Japanese silk industry. In 1972–73, however, there was a serious raw silk shortage in Japan; China was requested to make emergency exports to Japan, which accounted for the sharp 1972–73 rise in sales. The Japanese supply situation recovered in 1974, and silk imports declined dramatically. With the Japanese industry continuing to be protected, 1976 raw silk imports were less than a quarter of the 1973 peak. The Chinese raw silk effort has probably been further aggravated by competition from lower priced exports from South Korea and Brazil.

Since silk exports comprised the larger share of textile fiber exports, the fluctuations in Japanese raw silk imports during the 1972–74 period were reflected in earnings for the textile fiber group as a whole. Annual 1975 and 1976 earnings were much improved over 1974, but were based on a somewhat altered commodity structure. In 1975, for the first time, raw cotton exports appeared in enough volume to affect the size of fiber export earnings.

Fine animal hair (SITC 2623) was the remaining item of significance in the fibers group. Cashmere exports, which come under this classification, have been increasing, aided by rapidly rising prices.

Future hard currency earnings from textile fiber exports will probably increase, but only moderately. Prices for raw silk appear to be strong, as they do for cotton and cashmere. However, future additions to hard currency earnings from fiber exports will probably be based more on increases in silk and cashmere sales than on cotton, since cotton supplies are likely to be limited by slow agricultural growth. Another factor that may constrain future supplies of fiber exports in general is the Chinese attempt to turn these raw products into semifinished and finished goods, and thereby reap the benefits of value-added processing.

As in the case for textile fabrics, increases in hard currency earnings from fibers as a whole may also be limited by importing countries' restrictions, which are being imposed in an effort to protect domestic producers of textile commodities.

3. PETROLEUM

Since 1974, the single largest export commodity from the People's Republic of China has been crude petroleum. In 1976, earnings from crude oil deliveries amounted to $568 million, or nearly 12 percent of Chinese hard currency exports to our Twenty Country group. Combined with modest sales of petroleum products, 1976 earnings by the petroleum industry reached nearly $650 million and represented the second largest group of products (SITC 33) exported by the PRC—as a group, only textile fabrics were higher. What is significant about China's petroleum export trade is that it has been closely tied to the Japanese market. Prior to 1973, China's crude exports globally were negligible; in 1973, however, China's crude exports became notable as Japan imported $32 million of the product. Aided by quadrupling oil prices in 1974, oil earnings rose to $413 million, again solely on the basis of sales to Japan. Subsequent years' crude sales rose and fell with Japanese demand. Other countries have imported small amounts of Chinese crude, but in terms of hard currency earnings, however, Japan has clearly been the most important market, and will continue to be such for at least the next 10 years.

As noted earlier, a modest share of exports by the petroleum industry has consisted of petroleum products other than crude petroleum. These have accounted for roughly one-tenth of the petroleum industry's earnings from our hard currency countries and have been exported primarily to Hong Kong, probably for local consumption. Products in this category have included distillate fuels, lamp oil, kerosene, jet fuel, and residual fuel oils. Given the traditionally small share of the petroleum industry's export earnings derived from processed petroleum products, and an assessment that at least for the medium term, additions to Chinese refining capacity will be limited to satisfying rapidly increasing domestic demand, analysis of hard currency earnings by the petroleum industry will center on an examination of crude oil exports. This analysis will also focus on an examination of past performance and future prospects for sales to Japan.

In 1975, rising petroleum sales accounted for virtually all of China's increase in total export earnings over 1974. Between 1974 and 1975, total exports to The Twenty grew by only $464 million, of which $353 million, or 76 percent, was accounted for by petroleum and petroleum products deliveries. A doubling of crude shipments to Japan led the increase.

An opposite picture emerged for Chinese export growth in 1976. Total exports increased slightly, in spite of a sharp decrease in earnings from oil exports. Crude sales to Japan dropped by 23 percent both in dollar and volume terms; export earnings by the petroleum industry lagged seriously and accounted for a smaller share of China's export earnings in 1976 than they had in 1975, that is, 13 percent in 1976 as opposed to 17 percent in 1975. As of yearend 1977, the peak year for hard currency earnings from oil was 1975, both in absolute terms and as a share of total earnings.

The substantial drop in 1976 oil exports came in a year when crude output increased 13 percent. Though this increase was modest when compared to increases of 20 percent in prior years, it shows a good performance at a time when industrial output overall increased by, at best, 5 percent. Much of the increasing oil production probably came from new oilfields such as the North China field, which came on stream in 1976.

Of the 84 million metric tons produced in 1976, an estimated 10 to 11 mmt. were exported; of this, about 6.2 mmt. were delivered to Japan. Reports indicate that the Chinese were capable of exporting more crude to Japan, and that it was weak Japanese demand that precipitated the substantial drop in oil earnings, which in turn showed up as a decline in oil export earnings from The Twenty as a whole.

Although 1977 data are not yet available, there are indications that crude oil exports to Japan recovered only marginally from 1976 levels, to between 6.3 and 6.5 million metric tons. Given slight price increases, earnings probably increased by about 15 percent to $653 million, contributing roughly the same share to hard currency earnings from exports to The Twenty, that is, 11 to 12 percent, as in 1976.

The Long-Term Agreement negotiated between the PRC and Japan at the beginning of 1978 provides an outlet for China's crude through at least 1982.[14] Specific amounts of Japanese crude imports as negotiated under the Long-Term Agreement are provided in table 4.

TABLE 4.—*Japanese imports of crude petroleum from PRC, 1978 to 1982, as negotiated in the Long-Term Agreement*

	Million metric tons
1978	7.0
1979	7.6
1980	8.0
1981	9.5
1982	15.0

To assess the impact of potential oil exports to Japan contracted under the Long Term Agreement on future Chinese hard currency earning capability, we will establish a scenario which assumes (1) that non-oil exports will increase 10 percent annually, one percentage point higher than they did in 1976, and (2) that oil prices will be adjusted upwards by 5 percent each year from an estimated $13.20 per barrel in 1977.[15]

Assuming that the amounts of crude exported under the Long Term Agreement include crude that may have been exported at, say 1976/77 levels, then at least through 1980, oil exports will not contribute significant additions to China's hard currency earning capability.

A 1980 level of 8 million metric tons would merely approach the amount of crude exported to Japan in 1975, the peak year thus far.

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[14] The Long-Term Agreement also called for increasing exports of coal. Heretofore, China's coal exports have not been significant hard currency earners and hence have not been treated in this paper. In 1975, coal earned $17.6 million; 1976 earnings dropped to $12.6 million, largely as the result of the July earthquake's disruption of the Kailuan mines and transportation systems in general. Of the coal which has been exported during the seventies, virtually all has gone to Japan. In the future, if the level of coal exports envisaged in the LTA are realized, increases in earnings will be significant. Coking coal exports are expected to increase from .15-.30 mmt in 1978 to 2.0 mmt in 1982; anthracite deliveries are to rise from .15-.20 mmt in 1978 to 1.5-1.7 mmt in 1982. Whether or not these targets are fulfilled will depend upon two significant factors: future production gains will largely be affected by Chinese ability to allocate increased capital investment or mechanization and modernization and will also be affected by the growing energy requirements of the national economy.

[15] This may actually be high, as the contract could have given Japan a price advantage. However, in the interest of assessing the maximum contribution of oil to hard currency export earnings, we can allow this price to rise.

Looking to 1982, however, oil exports of 15 million metric tons would be just less than double the volume exported in 1975. However, earnings from these deliveries, as a percentage share of total projected earnings from exports to The Twenty, would probably not contribute much more than they did in 1975; assuming a 10-percent annual rise in non-oil exports, 1982 oil earnings would be about 19 percent of total earnings from The Twenty, whereas in 1975 they were 16 percent.

In order to meet the ambitious oil export targets set by the Chinese and charted through the Long-Term Agreement, China will need to increase production significantly. Production increases, however, will in some measure be dependent upon access to foreign technology, particularly from the United States, placing China in a position of having to import in order to meet export goals. Furthermore, to support its program of industrialization, China's own energy needs will be rising rapidly which adds to the question of whether China will be able to supply the amounts of oil laid out in the Agreement. On the demand side, Japan will need to construct new refineries to handle the heavy-wax Chinese crude. Although the difficulties over financing the construction have been overcome by government guarantees of substantial subsidies, the refineries must still be built.

In summary, hard currency earnings from oil exports will undoubtedly increase, and are likely to contribute a larger share to total hard currency earnings from exports to The Twenty in the near and medium term. Given the questions that have already been raised about China's future ability to supply a significantly expanded volume of crude, and questions concerning Japanese ability to absorb potentially large amounts of the product, it appears doubtful that oil exports in the medium term can earn hard currencies in large enough amounts so as to provide a complete answer to the Chinese export challenge.

4. FINISHED MANUFACTURES

Exports of finished manufactures (SITC 7 and 8) have accounted for about 14 percent of Chinese hard currency earnings from the 20 countries. Earning $700 million in 1976, finished manufactures ranked behind food and textile fibers/fabrics, but matched earnings from petroleum and petroleum products.

The most important two-digit product groups in the finished manufactures aggregation are clothing (SITC 84) and miscelleneous manufactures (SITC 89). Light industry manufactures dominate the finished products category, as China exports very little in capital goods.

Clothing (SITC 84) was the largest finished goods export, with items diversified over a wide range. Six of these appeared in the top 50 individual item breakdowns in Table 2: men's/boys' outer-and undergarments (SITC 84111 and 84113); women's/girls/infants' outergarments (SITC 84112); knitted or crocheted outer-and undergarments (SITC 84144 and 84143); and leather apparel and clothing accessories (SITC 8413). Importing countries absorbing a major share of Chinese clothing exports are Hong Kong (a good deal may be transshipped), Japan, and Canada.

Miscellaneous manufactures (SITC 89) is the other significant finished manufactures group. Commodities in this group are also widely diversified, with only basketwork/wickerwork (SITC 89922) appearing in the top 50 list. Other important miscellaneous manufactures exports are toys and antiques. Primary importers of miscellaneous manufactures items have been Hong Kong, Japan, and the United States. For some individual items, however, this pattern varied; for example, Western countries were important markets for both antiques and basketwork. Over one-half of Chinese antique exports in 1976 were imported by the United States, which probably represents a growing market for these items. France and the Federal Republic of Germany imported large amounts of basketwork and wickerwork.

Hard currency earnings growth from light industry manufactures depends to an extent on world market conditions. In 1975, for example, finished manufactures exports declined in response to weak markets; as Western economies began to recover in 1976, manufactures exports increased. Although 1977 data are not yet available, light industry exports probably continued to rise with improved Western market conditions.

Future prospects for increased earnings from finished manufactures depend, again, on continuing recovery on Western markets, growth in the light industry sector, and domestic demand. Looking at the Chinese supply side, we see growth in light industry through 1980 as moderate. However, to improve living standards, the industry will be coming under increased pressure to generate profits for investment. Large domestic demand, aided by recent wage increases, may indeed get a greater share of future output of manufactured goods, and thus constrain the amount available for export.

Turning to the demand side, we see limited growth potential for clothing, the largest light industry export. Western countries have already placed restrictions on future clothing imports, and Hong Kong, as a major clothing exporter, has been particularly affected. With 27 percent of China's clothing exports going to Hong Kong, it can be expected that these will also be affected. Exports of other light industry manufactures will probably rise, but expansion of hard currency earnings from finished manufactures as a group will most likely be moderate.

V. Summary and Conclusions

Unlike exports of other Communist countries, China's export trade has been dominated by exports to non-Communist countries; in 1976, non-Communist countries imported over 80 percent of China's total exports. Furthermore, the major portion of this non-Communist trade was denominated in hard currencies, so that bilateral clearing arrangements accounted for a relatively small amount of trade. Looking at China's recent exports to the 20 hard currency countries, we see a rapid growth. In value terms, exports increased nearly 2½ times between 1972 and 1976. The annual rate of growth, however, has exhibited a remarkable slowdown during that same period, declining from a 66-percent increase between 1972 and 1973 to a mere 4-percent increase between 1975 and 1976.

An examination of the composition of China's exports to the 20, which are assumed to be representative of China's hard currency capability, reveals that they have been dominated by food products, textiles, crude materials (such as fibers), fuels, and finished manufactures. Hard currency exports are fairly diversified, and except for oil, no single commodity accounts for a major share of hard-currency earnings, and even oil exports contribute a relatively modest share (13 percent) to total hard currency earnings.

The composition of China's exports has remained relatively stable. Perhaps the only exception is the recent growth in oil exports.

China's exports have also benefited from increasing world market prices, as overall Chinese export growth in real terms has advanced more slowly than dollar earnings would suggest.

The geographic distribution of China's trade is heavily oriented toward countries of the Asia basin. Among exports going to the 20 countries examined in this paper, only one-fourth was absorbed by Western Europe and North America.

Looking to the future, Chinese hard currency export growth in the near to medium term will probably be moderate. Exports during the current 5-year plan period will continue to recover from the setbacks of the mid-seventies, which were brought about by internal economic disruptions and sluggish world demand. By the end of the 1970's, the stage should be set for expansion, as opposed to recoupment currently being witnessed. The commodity composition of exports could change somewhat if, as some expect, oil exports expand significantly and if some of China's traditional exports are hampered by Western import restrictions.

Petroleum appears to be a candidate for the most rapid export growth. To a large degree, the growth of petroleum deliveries for the remainder of the 1970's and into the 1980's has been charted by the Japan-China Long-Term Agreement of February 1978. It is possible, however, that in 1982, the year in which petroleum exports outlined by the Long-Term Agreement will be at their peak, hard currency earnings from oil will not provide a much greater share to total hard currency earnings than in 1975.

Underpinning the hopeful, though uncertain increases in earnings from oil, will be a continued reliance on exports of traditional commodities, namely foods, textile fabrics, textile fibers, clothing, and miscellaneous manufactures. Food and raw materials products will remain important to Chinese hard-currency earnings, and the composition of this category is not likely to change very much. Fruits, vegetables, fish, rice, swine, raw silk, cashmere, raw cotton, and down will continue to dominate the food and raw materials export group.

Light industry manufactures, which include such important Chinese export items as textile fabrics, clothing, basketwork, antiques, porcelain pieces—and account for about one-fourth of China's exports to The Twenty hard currency countries—will probably be hard pressed to significantly expand hard currency earnings in the near to medium term. The larger part of light industry manufactures fall into the category of import sensitive items. EC restrictions against clothing and textile imports will probably affect Hong Kong more than any other country. This will undoubtedly have repercussions on China's exports of these commodities, as Hong Kong has been the largest market for Chinese clothing and fabrics. Continued Japanese restrictions against these same commodities will further dampen hard currency earnings growth. Other light industry manufactures exports—basketwork, porcelain, antiques—will expand. It is unlikely, however, that earnings will be large enough to offset the potential slowdown in earnings from clothing and textiles.

The pace of overall growth in hard currency earnings from The Twenty countries depends therefore, upon several factors: (1) oil exports to Japan, (2) growth in importing countries' demand for nonsensitive items, and (3) the trend in Western import protectionism. One also cannot ignore domestic demand requirements, particularly in the face of the Hua leadership's commitment to improve the Chinese standard of living.

China's export orientation is likely to remain in the Asia basin. The Japan-China Long-Term Agreement has mapped an orderly course of Japanese-Chinese trade expansion through at least 1985. Hong Kong, by reasons of geography and traditional ties, will also remain an important Asian trading partner.

In the longer term, the United States and Western Europe may be large markets for Chinese goods. In the near to medium future however, these will remain secondary. Although the EC-China trade agreement offered an indication that China was looking to Western Europe, the current composition of Chinese exports makes it unlikely that a large surge in hard currency earnings can come from that area. As for the United States, though a potential market for Chinese goods may exist,[16] in the absence of normal diplomatic ties commercial relations will be limited. It appears, therefore, that in the near to medium term, the market shares of Chinese goods taken by importing countries will remain relatively unchanged.

The current leadership's more positive orientation toward foreign trade and its stress on the importance of trade in advancing China's economic development speaks favorably for Chinese imports from industrialized countries. Given the leadership's conservative financial policies, however, the ability to increase imports will rest largely on hard currency export performance, which in the near to medium term appears to have only moderate growth potential.

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[16] For a quantitative analysis of one aspect of normalized trading relations, namely, MFN tariff treatment, see, in the volume, the study entitled, "The Impact on PRC Exports of U.S. Most-Favored-Nation Tariff Treatment", by Helen Raffel and Cheryl McQueen.

THE IMPACT OF MOST-FAVORED-NATION TARIFF TREATMENT ON U.S. IMPORTS FROM THE PEOPLE'S REPUBLIC OF CHINA

By Philip T. Lincoln, Jr., and James A. Kilpatrick*

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I. Introduction

The United States presently maintains a two-tiered tariff system with rates that are usually higher ("column 2" or "non-most-favored-nation" rates) applying to U.S. imports from the People's Republic of China (PRC) and most other Communist countries. The lower rates ("column 1" or "most-favored-nation" rates) apply in general to U.S. imports from all other countries.

The question of extension of most-favored-nation (MFN) tariff treatment to the PRC is of interest because, since the resumption of bilateral trading relations in 1971 after a 20-year hiatus, lack of MFN treatment is one of the few discriminatory legal constraints on U.S. imports from the PRC, and it is the most significant of such barriers. U.S. imports from the PRC have grown slowly, from about $5 million in 1971 to about $202 million in 1976. The 1976 figure was approximately 3 percent of the PRC's total exports in that year, and less than 1 percent of U.S. world imports.

This relatively low level of imports raises the question of whether the lack of MFN tariff treatment is seriously hindering U.S. imports from the PRC and, more specifically, what can be expected in terms of increased trade if this barrier is removed. The PRC, in general, has attempted to follow a policy of balanced trade with most of its bilateral trading partners, and extension of MFN treatment to the PRC, to the extent that U.S. imports increased as a result, would enhance the prospects for additional PRC purchases from the U.S. Extension of MFN treatment would also be expected to improve the general climate in which U.S.-PRC bilateral trade is conducted.

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The main purpose of this study is to estimate the effect that reduced tariffs under MFN would have on the level of U.S. imports from the PRC. Since a tariff reduction is in principle equivalent to a reduction in the price of imported goods, this study approaches the question of the effect of a potential tariff reduction on the basis of recent experience with changes in prices and the levels of U.S. imports of various goods which are important in U.S.-PRC trade. First we provide further background on MFN and some of the previous efforts to deal with the question of discriminatory tariff treatment—including the methodological and empirical problems which must be accounted for. Then, the restrictive effect that the two-tiered tariffs have had on U.S. imports from the PRC is measured, using a methodology which, we believe, represents an advance over that used in previous MFN studies. Finally, an attempt is made to measure the impact that increased imports from China under MFN would have on the number of people employed in competing U.S. domestic industries.

II. BACKGROUND

The concept of Most Favored Nation treatment has been defined as—

> A provision, generally inserted in a commercial agreement between two states, which obligates the contracting parties to extend all concessions or favors made by each in the past, or which might be made in the future, to the articles, agents, or instruments of commerce of any other state in such a way that their mutual trade will never be on a less favorable basis than is enjoyed by that state whose commercial relations with each is on the most favorable basis.[1]

This broad definition applies to all aspects of a nation's trading relations with other countries. As applied to tariffs, MFN treatment means in essence that any reductions in tariff rates made in an agreement with one country apply automatically to all other countries which enjoy MFN treatment, even if the provisions were not specifically included in formal agreements with those other countries.

The United States has for more than 50 years generally followed an unconditional MFN policy in its trading relations. However, an important exception to this general policy was instituted in the early 1950's. Under the provisions of the Trade Agreement Extension Act of 1951, MFN status was withdrawn from all nations "under the control of international communism." The Trade Expansion Act of 1962 expanded this definition to include "all Communist countries." Determinations were subsequently made that Yugoslavia, and later Poland, were not Communist countries under the definitions of these laws, and both countries were permitted to retain their MFN status. All other U.S. trading partners currently receive MFN tariff treatment.

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[1] Richard Carlton Snyder, "The Most-Favored-Nation Clause," King's Crown Press, 1948, p. 10. Quoted in Elias and Searing (1974).

Leaving aside possible political rationales for this discriminatory policy, there are also some economic-related reasons. Until recently, Communist nations were not parties to the GATT and therefore had not ascribed to the GATT principles of the conduct of trade. Given the high degree of control that the Communist governments exercise over their economies, and the lack of a functioning market mechanism, these governments could arbitrarily introduce discriminatory measures by administrative decree in their bilateral trade relations, causing preference to be given or denied imports from (or exports to) any particular country. The activities of foreign businessmen are circumscribed, and the foreigners are at a negotiating disadvantage because they must conduct business with centralized state trading monopolies which are backed by the full weight of their governments. The economic case for free trade assumes that a free trade regime is the most efficacious way to achieve optimal resource allocation so as to maximize satisfaction with the distribution of goods and services. Free trade depends on the fulfillment of efficiency conditions (such as no monopoly, external economies, or distortions of market price from social values), and acceptance of the income distribution it provides.[2] Active intervention in the market mechanism by a country or group of countries is likely to result in unequal distribution of the gains from trade.

On the other hand, if the United States were to unilaterally extend MFN treatment to the Communist countries, these countries would in principle have access to the United States market on the same basis as other United States trading partners. Furthermore, the United States, unlike many European countries, does not maintain quantitative restrictions on imports from Communist countries.

One way to compensate for the lack of reciprocity implicit in the trading relationships between two countries with widely differing economic systems is to conduct the trade under the framework of a broad intergovernmental bilateral agreement. In recent years, the United States has sought agreements with some Communist countries, under which the United States extends MFN tariff treatment, and access to the United States market on the same basis as other trading partners, in return for guarantees and concessions concerning trade levels, government-to-government consultations, facilitation of the activities of businessmen, and improvement of other aspects of bilateral trade.

The Trade Act of 1974 incorporates this approach. Under the provisions of this law, MFN tariff treatment can be extended to Communist countries (including the PRC) which do not have it by means of bilateral trade agreements. These agreements must contain a number of specific provisions concerning such matters as intergovernmental consulations on trade, industrial property protection, trade promotion and facilitation, and market disruption. The agreements are subject to congressional approval by concurrent resolution, and the President must satisfy Congress that these countries do not deny their citizens the right to emigrate and that they do not deny their citizens the right to join close relatives in the United States. So far, only one country—Romania—has received MFN tariff treatment under the provisions of the Trade Act of 1974.

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[2] See Kindleberger (1973), pp. 189–90 and 204.

The extension of MFN tariff treatment to the PRC or one of the other countries that does not have it should result in a lower price for that country's exports in the United States. This should lead, in principle, to some increase in exports of the new MFN recipient's products to the United States at the expense of U.S. domestic production on one hand and competing imports from other foreign countries on the other. Most previous studies of the MFN question have concentrated—explicitly or implicitly—on the extent to which the new MFN recipient's imports would displace the products of other foreign countries in the U.S. market. Only a few studies have attempted to measure quantitatively the impact of MFN extension.

Most of the work has focused on the Soviet Union and Eastern European countries. Most of these studies have used a "comparative market" technique. Typically, in order to determine a hypothetical increase in imports to the United States from the potential MFN recipient(s), a comparable market, or "reference market," is chosen as a proxy for the U.S. market. The reference market, of course, is one which does not impose discriminatory tariffs on the Communist country's (centrally planned economy's—or CPE) products. The CPE's share of the reference market is calculated for various products and the assumption is made that U.S. imports from the CPE would reach this level of market penetration if trade were fully "normalized." Other, nontariff, constraints on trade should be isolated from the discriminatory tariff effects.[3] The usual technique is to separate those commodities for which there is a significant difference between the U.S. MFN and non-MFN tariffs from those for which the difference is not significant. For the latter group, any differences in market penetration between U.S. imports of these commodities and the equivalent imports in the reference market can be ascribed entirely to non-MFN related factors. Therefore, the MFN impact for the other group of commodities can be determined as a residual, by subtracting from each of the commodities in this group an amount proportionate to the nontariff constraint effect determined for the first group of commodities.

One problem with this approach is that it implicitly assumes that the two groups of commodities—those with significant MFN and non-MFN tariff differentials and those without—share similar characteristics except for the tariff differential.[4] In fact, U.S. tariffs in general, as well as the tariff differentials, tend to be much lower for raw materials and semi-manufactures. Usually, the higher the stage of manufacturing of a product, the higher the tariffs in both columns and, frequently, the higher the tariff differential.[4] Another problem is that the degree of market penetration for a particular commodity in the United States can never, under this approach, exceed that of the reference market. If the market penetration in the United States for the commodities with significant tariff differentials should, over time, approach the level of the reference market, the implication would be that the impact of MFN extension is declining. (If the level of market penetration in the two markets were equal, the implication would be that MFN extension would have no impact.) This is inconsistent with economic theory, which suggests that, for those commodities with normal demand curves, the effect of a reduction in price caused by a tariff reduction is an increase in quantity sold. If the demand curve for a product does not shift over time, the impact of MFN extension should remain the same, relatively, although the absolute value of MFN extension might increase. The comparative market approach is discussed further in appendix A.

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[3] Lack of MFN tariff treatment is not the only handicap that Communist countries have experienced in exporting to the United States. Unfamiliarity with the U.S. market generally, including its merchandising practices and product standards (including styling), as well as difficulties in meeting legally mandated health and consumer protection requirements, have all constrained the levels of U.S. imports from these countries.

[4] In this study, the term "tariff differential" means the difference between the TSUS column 1 and column 2 ad valorem tariff rates.

In addition to some estimates contained in a paper by John Jelacic,[5] we are aware of five other studies which deal with the question of the impact of MFN on the level of U.S. imports from the PRC. One of these studies dealt with the question qualitatively on a commodity-by-commodity basis. All of the others used some variation of the comparative market approach. Only one arrived at a quantitative estimate of the impact of MFN tariff extension on import levels from the PRC. These studies are discussed in appendix B.

In summary, the following are some of the substantial methodological and empirical problems which must be dealt with in measuring MFN impacts: (1) *Selection of commodities for study and level of disaggregation.* Unless the researcher is prepared to study literally hundreds of commodities, some selectivity must be exercised. Criteria must be developed to determine which commodities are most affected by lack of MFN. Characteristics of individual markets must be taken into account. Working with highly aggregated statistical data causes difficulties related to the dissimilarity of the various individual commodities within the larger groupings; this is particularly a problem when intercountry comparisons are made. Working with highly disaggregated data may facilitate the use of differing data series and will, of course, yield more information on the precise effects of MFN extension. (2) *Treatment of Tariff Differentials.* If the commodities being studied are not defined as precisely as the U.S. International Trade Commission defines them in the U.S. tariff schedules, adjustments must be made to make the duties applicable to the commodities studied. The duty rates must also be pertinent to the time period studied. The rates vary from year to year, and the column 1 rate since the late 1960's has been reduced considerably following succeeding rounds of multilateral tariff negotiations. There are two bases for assessment of duties. Specific rates are assessed by quantity, weight, or measure without regard to value. Ad valorem duties are assessed at a certain percentage of the dutiable value (which differs from the standard CIF value) of the merchandise. An assumption must be made about the impact of the specific duties (the usual assumption is to ignore them). If ad valorem tariff equivalents are calculated, a decision must be made concerning whether to weight them according to some conception of the potential composition of the trade after MFN.

(3) *Methodology for Separating the MFN Effects from the Effects of the Nontariff Barriers.* This is particularly a problem for the comparative market studies. (4) *Supply Assumptions.* An assumption must be made about the elasticity of supply of the exporting CPE. The CPE may meet the increasing demand for its exports after MFN extension by diverting supplies from other markets or by increasing domestic production for export (or neither or both). Many studies have assumed

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[5] Jelacic (1974).

infinite supply elasticity. (5) *Time Dimension.* The study may measure the hypothetical effect of MFN extension in some prior year, or project the impact to some future time; it may also investigate the length of time it takes the price adjustment effects resulting from MFN extension to work themselves out in the U.S. market.

III. METHODOLOGY

1. General

Using data on values and quantities of a number of goods imported into the United States, the present study estimates the elasticity of import demand (with respect to price) of commodities important or potentially important in U.S.–PRC trade. These elasticity estimates were applied to current and projected levels of U.S. imports from the PRC, using two groups of commodities at differing levels of disaggregation, in order to predict the change in imports of each good which would result from the potential tariff change. The following equation was used to estimate this change:

$$dV = \frac{\hat{\eta} V_0 (t_1 - t_2)}{1 + t_1} \tag{1}$$

where dV is the change in value of imports after MFN extension (before duty is assessed), V_0 is the value of imports before MFN, t_1 is the Column 1 rate and t_2 is the column 2 rate, and η is the relevant elasticity.

The empirical steps were selection of the commodities to be included, measurement of the relevant price elasticities, calculation of ad valorem tariff equivalents for one of the groups of commodities and, finally, calculation of the actual commodity-by-commodity and total MFN impact.

This approach makes use of the best features of the methodologies used in previous studies, and represents a substantial improvement over those relying exclusively on the comparative market approach. This methodology permits more accurate estimation of the effects of the tariff reductions because it focuses specifically on the price elasticity of import demand for each good, based on recent experience with U.S. imports of the goods. Since it is the import prices of the goods which will, in effect, be altered by the tariff reductions, from the standpoint of economic theory the price elasticities are the appropriate quantities to use in estimating the effect of MFN extension.

There were, however, a number of problems which could not be dealt with in a completely satisfactory way. First, we have assumed infinite elasticity of PRC export supply. This assumption was necessary as a practical matter, and it means that our research is focused on the U.S. domestic reaction to the tariff cut and not on the PRC reaction. To the extent that the assumption is untrue, our estimates will be biased upward by an unknown amount. At present levels of trade, however, there does not appear to be any reason to believe that the Chinese would be unable to supply the U.S. market with the projected increments of export goods, so the assumption in reality should not be too damaging. Second, the elasticity of import demand with respect to rather large price changes, such as might occur under MFN extension, may differ from the elasticity with respect to relatively small period-to-period changes in price such as those usually exhibited in our data. This could impart a downward bias in the results. Third, the functional form of the demand equation used has the characteristic of constant price elasticity over all price ranges and, strictly speaking, is applicable only to the intermediate portions of the relevant demand curves. Therefore, for some products where the U.S. levels of imports are particularly low (approaching zero), there may be a downward bias in the MFN impact estimate. Efforts were made to correct for this, and it is not believed to be a serious problem. Fourth, there may be some downward bias in the results due to selectivity in the commodities covered. However, we believe all important commodities were included. Finally, the Chinese might, after the extension of MFN, raise their prices to offset the amount of the MFN tariff differential, so that there would be no increase in trade, and the PRC would capture the revenue from the tariff instead of the U.S. Government. In fact, as will be shown, there may be circumstances in which it would probably be in their interest (in a revenue-maximizing sense) to do this. Chinese behavior in this regard is, of course, impossible to predict.

Our approach, in summary, is designed to predict the reaction of U.S. importers and consumers to extension of MFN tariff treatment to the PRC, on the basis of recent experience with imports of the goods we import from China. Despite its possible shortcomings, we believe the methodology we have chosen offers the best possibility of making use of existing data and economic theory to predict the effect of potential MFN extension.

2. Commodity Groupings

In this study, MFN impact is estimated for two groups of commodities. The first group, designated "leading commodities," consisted of the most important U.S. imports from the PRC in 1975, disaggregated at the seven-digit TSUS level, arranged in order of descending value. This group consisted of 50 commodities valued at $126.8 million (customs valuation), constituting about 80 percent of U.S. imports from the PRC for that year. At this level of disaggregation, the precise tariffs were known. Products admitted duty free or those for which the column 1 and column 2 rates were equal were eliminated. This left 37 commodities. Of these, eight commodities were assessed specific duties only. Three commodities were eliminated from consideration because the price elasticity could not be calculated empirically.[6]

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[6] These 3 commodities were:

Description	TSUS	SITC	Value
Paper, cloth, abrasive coated	5195100	66320	$553, 789
Precious and semiprecious stones, suitable for jewelry manufacture, n.e.s	5203900	66730	629, 240
Other precious and semiprecious stones, and articles, n.e.s., other	5206100	66730	669, 101

NOTE.—Since the "U.S. General Imports, Schedule A, FT-135" does not list quantity figures for these imports, price elasticities could not be calculated; suitable substitutes could not be found.

The advantage of this grouping of commodities was that it provided a relatively precise definition of the individual products which facilitated the calculation of the relevant price elasticities and the straightforward use of the elasticities to determine the change in import value after MFN extension. Also, it was not necessary to use ad valorem equivalent tariff rates. A principal disadvantage, however, was that it failed to take into account those commodities which were partially or totally barred by the lack of MFN. Therefore, it seemed desirable to develop a more highly aggregated and extensive grouping of commodities to take this effect into account.

In order to estimate the MFN impact on commodities not being imported (as well as those currently imported), a second group of commodities at the three-digit SITC level was selected. Chinese exports to the OECD countries for 1974 were examined and a listing was made of all commodities at the three-digit SITC level for which total PRC exports exceeded $1 million. This list consisted of some 85 commodities. However, there were various a priori reasons to question whether the PRC would have been able to export all these commodities to the United States in significant quantities even if trade were essentially normalized, except for MFN. Therefore, some of these commodities were removed from further consideration on grounds of presumptive PRC supply difficulties, commodities idiosyncratic to PRC-Japan trade, low U.S. demand, and products for which there were U.S. legal or regulatory bars. This selection procedures could be criticized on the ground that it is essentially arbitrary. Inclusion of all these commodities, however, would have introduced an unacceptable level of upward bias in the results.

It is, of course, not possible using conventional demand analysis to measure the effects of small price changes for goods not currently being traded. Also, as indicated above, the price elasticities determined empirically in this study are not strictly applicable to commodities traded at low levels (represented by an extreme point on the relevant demand curves).

Therefore the problem was formulated in the following way: If trade in these commodities were at a particular hypothetical level, and given the characteristics of demand in the U.S. market for these products, what would be the price impact of MFN extension at that level? For the purpose of determining an appropriate import level, we selected the nine countries of the European Community (EC) as the reference market. Using the comparative market technique, we asked: If the PRC could achieve the same degree of market penetration for these commodities in the U.S. as achieved in the EC, what would the level of imports be? The EC was chosen as the reference market because it approaches the U.S. market in size and volume of imports. Also, transport costs from the PRC are roughly comparable. Features of markets in individual European countries which differ from the U.S. market would hopefully be offset to some extent by using the countries as a group. Canada was not chosen as a reference market because of the small size of the Canadian market and the problems that Elias and Searing experienced using Canada.[7] U.S.

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[7] Elias and Searing (1074), p. 612–613.

projected imports of each commodity from the PRC for 1974 were calculated using the following equation:

$$(2) \quad \text{U.S. Projected Imports (PRC)} = \text{U.S. Total Imports} \times \frac{\text{EC Imports (PRC)}}{\text{Total EC Imports from outside EC}}$$

The difference between the hypothetical and actual levels of U.S. imports constituted the trade shortfall.

The projected levels were assumed to represent trade under "normalized" conditions. Commodity groups for which projected U.S. trade did not reach at least $900,000 (in 1974) were dropped, leaving 42 groups. The remaining commodity groups included about 92.3 percent of U.S. imports from the PRC in 1974 and 97.5 percent in 1975. Ad valorem tariff equivalents were calculated for the remaining commodity groups. The MFN effect at the projected level of trade was calculated using the estimating equation on page 817.

It should be noted that there is some overlap between the leading commodities grouping and the three-digit SITC grouping; the latter more highly aggregated grouping includes most of the commodities in the former.

3. Price Elasticities

Extension of MFN to the PRC would, as previously noted, theoretically cause U.S. imports from that country to increase due to two effects: (1) substitution of PRC products for domestically produced products, and (2) substitution of PRC products for goods formerly imported from other foreign countries.

Considering the second effect first, the appropriate measure of the extent to which PRC goods will substitute for other foreign goods is the elasticity of substitution, defined as:

$$\eta = \frac{\dfrac{\delta(q_1/q_2)}{q_1/q_2}}{\dfrac{\delta(p_1/p_2)}{p_1/p_2}}$$

where q_1 and p_1 are the PRC prices and quantities of the i^{th} good and q_2 and p_2 are the prices and quantities for the competing exporting countries. As Leamer and Stern [8] point out, the concept of elasticity of substitution raises theoretical difficulties and is also difficult to measure. If the Chinese good and the competing good are perfect substitutes, American consumers will purchase only the lower priced product. Therefore a tariff reduction for the PRC good should cause American consumers to stop buying those competing imported goods which, after MFN extension to the PRC, became more expensive. This implies that the elasticity of substitution is ∞ when $p_1 = p_2$ and 0 elsewhere. Leamer and Stern further show that the commonly used procedure for estimating elasticity of substitution is valid only under certain restrictive conditions.

Because of the theoretical and practical difficulties involved, it did not seem feasible to attempt a separate estimation of the elasticity of substitution of various Chinese goods vis-a-vis imports from competing foreign countries. In estimating the impact of MFN extension for the leading commodities group, the import substitution effect was not measured. This introduces a downward bias which is difficult to estimate. For the three-digit SITC grouping of commodities, assuming the comparative static benefits of trade normalization are realized and the PRC achieves the same degree of market penetration in the United States as achieved in the EC, the import substitution effect of MFN extension is implicitly included in the projected market share.

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[8] See Leamer and Stern (1970), ch. 3.

For the purpose of calculating price elasticities for both commodity groupings, representative commodities were chosen from the U. S. General Imports, Schedule A, FT–135 series published by the U.S. Department of Commerce. (The classification system used in this publication is similar to, but not exactly the same as, the SITC system.) For each commodity four estimates of the U.S. price elasticity of demand were obtained. The four estimates were based on two time series of data and two estimating equations. The first time series is for total U.S. imports of the commodity, and the second is for U.S. imports of the good from an "analog" country. Because the recent history of United States-People's Republic of China trade is short, and the level of trade in some commodities is low, it was not feasible to estimate the demand schedule facing the PRC in the U.S. market using actual United States-People's Republic of China trade data. A proxy had to be used. The analog countries were chosen because of similarity between their exports and those of China. The principal criterion was price. Whenever possible, an East or Southeast Asian LDC was chosen.

We chose to use both total imports in each category and the imports from individual countries, because we believe it is possible that demand for imports of a good from a single country such as the People's Republic of China may be more or less price elastic than total demand for imports of the good. This was supported by preliminary investigations of the relevant commodities which indicated that there was a wide range in unit prices, even at the level of disaggregation at which we were working. Furthermore, if there is a change in price for all imports of a given commodity, the imports would not gain in competitiveness with one another, but only in relation to domestic producers. Taking into account the elasticity of substitution, the import elasticity for an individual country importing to the United States should be greater than those for the importers as a group.

We used two regression equations on each time series in estimating the price elasticities, thus giving a total of four estimates. The first equation is quantity imported regressed on price (where price is a ratio of the import price and domestic price) and the second is quantity imported regressed on both price and on U.S. GNP in constant dollars. While there are in reality a great variety of factors influencing the level of U.S. import demand for each of these commodities over the period considered, it would be impossible to determine what all of these factors were for each good and to include them all in an appropriate form for estimation. Therefore, these two relatively simple equations were chosen to focus on price.

We do not propose that any single estimate of price elasticities of U.S. demand for imports of these commodities necessarily represents exactly what U.S. consumers and importers will do with respect to future imports of the Chinese goods. Our purpose is simply to make the best use of available information to predict the most likely outcome on the basis of behavior in the recent past. Given this objective, we have estimated a range of potential results based on several elasticity estimates for each commodity. It should be noted that this range is not a confidence interval for the estimated change in the level of trade, but is rather a range of potential outcomes predicted on the basis of our data and estimates.

Because the United States is party to a multilateral agreement on textiles and apparel which restrains the level of U.S. imports of these products, it could be argued that the elasticities estimated empirically were biased downward. To meet this potential objection, we included MFN estimates using price elasticities estimated by others, in addition to our own estimates, in the case of apparel. For textiles, this was not necessary because our estimates were comparable to those of others.

4. Data and Estimation

The data we used to estimate the elasticity of U.S. demand for imports of the goods are quite well disaggregated. All commodities were at the seven-digit schedule A level. There were a total of 61 commodities included. Twenty of these related primarily to the "leading commodities" grouping; the remaining 41 were related primarily to the "three-digit SITC" grouping. The former commodities are imported in substantial quantities by the United States (generally over $500,000 per year). The latter commodities are usually important Chinese exports, but are not as yet imported into the United States from the PRC on a large scale; also, these commodities are usually important U.S. imports from other Asian LDC's. With regard to the "three-digit SITC grouping," this procedure is subject to the criticism that the elasticities for the commodities selected may not be representative for the three-digit group as a whole. There is certainly some justification for this. The alternative would appear to be: (1) Measure the elasticities for all relevant PRC exports, fully disaggregated (this would be costly and time consuming); or (2) construct a composite import commodity at the three-digit level based, presumably, on PRC trade with other developed markets. This would involve a priori decisions on which commodities to include and how to weight them. We do not believe the results would necessarily be any more accurate than the procedure employed here. For all the important "three-digit SITC" commodity groupings we have selected at least two, and as many as seven, analog commodities. As previously noted, there were four estimates made for each commodity.

For each commodity used to estimate a price elasticity, data for U.S. imports were recorded for 6-month periods in 1970–75 (a total of 12 periods). This was done for total U.S. imports of each commodity and for imports from the analog countries. Thus for each commodity there were at least two time series of data, one for total U.S. imports and one for U.S. imports from an analog country. In addition, we recorded data on U.S. domestic wholesale prices of each commodity for each 6-month period. For import prices, we used the unit values of the goods, since data on prices per se were not available.

In order to make the elasticity estimates, we first calculated the ratio p_i/p_d (where p_i is the unit value of the imported good, and p_d the domestic wholesale price) for each good in each period, both for total imports and for each analog country. We then regressed the quantity imported (in natural log form) on this price ratio (also in log form) and a time-period dummy (equal to 1 in the first 6 months of each year, and equal to −1 in the second 6 months). The period dummy was included to partially account for seasonal differences in demand and in reporting of data. The estimating equation, thus, was:

$$\log Q_t = \log A + a(\text{dummy})_t + b \log(p_i/p_d)_t + e \tag{3}$$

where Q is the quantity imported, A a constant, and e the error term. The estimated price elasticity is b. The equations were estimated by least squares regression. Serial correlation was tested for in each regression using the Durbin-Watson statistic, and an estimate of ρ (for a first-order autoregressive equation) was calculated. For cases in which the estimated absolute value of ρ was greater than 0.25, the equation was reestimated using a first-order scheme, and the estimate for the price elasticity from this reestimation was used.[9]

The price elasticity was also estimated from an equation which included the value of the U.S. GNP in constant dollars:

$$\log Q_t = \log A + a(\text{dummy})_t + b \log(p_i/p_d) + c \log(\text{GNP})_t + e \tag{4}$$

Again, b is the estimated price elasticity. The same procedure was used to test for and correct serial correlation.

In summary, the following are the principal advantages of the methodology employed in this study, as compared to previous studies: (1) Direct measurement of the price effect of MFN extension in the U.S. market, based on price elasticities; (2) estimation of elasticities based on disaggregated commodity time series which are relevant to the particular goods exported by the PRC; (3) inclusion of MFN estimates for highly disaggregated groups of commodities; (4) calculation of MFN effects for nontraded, as well as currently traded, goods; (5) allowance for import substitution effects (with competing foreign countries) as well as domestic substitution effects; (6) use of ad valorem tariff equivalents, where required, that are based on duty rates currently in force.

5. Impact on U.S. Domestic Employment

The impact that increased imports from China under MFN could have on the number of people employed in competing U.S. industries is an area that attracts considerable public attention and debate. The effect of the extension of MFN on U.S. domestic employment is of great importance from the point of view of public policy.

Measurement of this effect ideally requires a set of multipliers which give the number of jobs gained or lost at any level of imports of each commodity. These should be well disaggregated and should include both the direct impact on the competing industry and the indirect impact of the first-round change in employment on the rest of the economy, calculated from an adequately detailed set of equations.

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[9] See Kmenta (1971), pp. 287–288, for more details on this procedure.

The model used in estimation should account for the displacement of workers in competing domestic industries and also for two compensating factors. One of these compensating factors is that not all of the increase in Chinese imports would be at the expense of U.S. industries. Some, or even most of it, would displace imports from other countries. Second, the direct effect on employment in competing domestic industries might presumably be at least partly offset by increases in exports induced by our increase in imports.

Measurement of all these effects would require an extremely complex model. Estimation of all the parameters of such a system of equations would, as a practical matter, be nearly impossible. In this study we have used a relatively simple method to measure the impact of our estimated changes in imports on employment.

The model we use here does meet our first set of criteria. It uses disaggregated multipliers obtained from an input-output model which captures both the direct and indirect effect of imports on employment. For the sake of accuracy, it is probably these criteria which are most important. The second set of criteria, concerning effects on trade with other countries, cannot be measured satisfactorily in adequate detail. Our estimate of the effect of imports under MFN on domestic employment is therefore probably somewhat higher than the true effect would be.

The labor effects for each category of goods was calculated using the U.S. Labor Department's input-output model of the U.S. economy.[10] Since that model uses the SIC classification—mainly used for domestically produced goods—while our study categorizes goods on the basis of the SITC classification—used for trade—it was necessary to develop a concordance. This was done using the TSUS classification as an intermediate step.[11] For each three-digit SITC category, one or more three-digit TSUS categories were found which corresponded to it. Then, for each three-digit TSUS category, one or more six-digit SIC categories were found. Thus for each of the three-digit SITC categories used in this analysis, one or—usually—more six-digit SIC categories were found to correspond.

With the aid of the Labor Department's model, a labor-output ratio was found for each of these SIC categories. This labor-output ratio was the total—direct and indirect—ratio of employees per million dollars of output in 1967 dollars, given 1973 productivity levels. These ratios were then adjusted to current prices using the deflators used in elasticity estimation, and productivity levels were adjusted by a factor of .9885, the ratio of aggregate U.S. productivity in 1975 to that in 1973.[12] The labor-output ratios for these disaggregated six-digit categories were then aggregated to the level of the three-digit categories being analyzed here by taking the mean of the ratios for all the six-digit SIC subcategories which fell under each three-digit SITC category. All of this was rather complicated; but once these labor-output ratios were obtained for each three-digit category, calculating the labor impact was very simple.

The labor-output ratio for each good was simply multiplied times the estimated change in U.S. imports. The results of this are summarized in table 5. It should be re-emphasized that these are the maximum effect that would be expected for each commodity, and almost certainly are higher than the effect would be in reality.

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[10] See "The Input-Out Structure of the U.S. Economy: 1967," in Survey of Current Business, February 1974, pp. 24–56.

[11] Following U.S. Department of Commerce, Bureau of the Census, "U.S. Trade Statistics Classification and Cross-Classifications, 1974."

[12] See U.S. Department of Labor, Bureau of Labor Statistics, Monthly Labor Review, December 1977, p. 113.

IV. RESULTS

In general, the import price elasticities calculated seemed relatively low, for both traded and nontraded goods. Of the 61 commodities studied, 35 could be considered price inelastic, 20 moderately price elastic and only 6 seemed highly price elastic.[13] As might be expected, the products which had undergone one or more stages of manufacturing showed greater price elasticity than those which had not. Of the 26 highly- or moderately-price elastic goods, 22 were manufactured.

One possible explanation for the relative price inelasticity of these products is simply that the weight of price as a determinant in the quantity imported may be less than that of other factors.[14] U.S. imports in many of these categories have been growing rapidly in the early seventies, especially from LDC's, and providing that a country's product is reasonably price competitive, U.S. importers may place more weight on such factors as consistency of supply and flexibility of the exporter in meeting design, packaging, and shipping requirements. Another explanation may be that many of these goods are simple and standardized and U.S. demand for them is, accordingly, inelastic.

For those products with elasticities less than −1.00, reductions in the domestic U.S. price due to MFN extension will result in a reduction in the total domestic—that is, after tariff—expenditure on those imports. From the Chinese point of view, total revenue from exports to the United States will always increase as a result of MFN extension. However, for at least some of those products with elasticities of less than −1.00, PRC total revenue would be greater if prices were adjusted upward by the amount of the tariff differential—and the same quantity sold—rather than if the products were sold in these United States at the new price, lower by the amount of the tariff differential.

1. Leading Commodity Grouping—Results

First of all, it is worth noting that a relatively high proportion of the top 50 commodity imports from the PRC in 1975 were either entering duty free, or at rates equal to the column 1 rate, or with only specific duties assessed. For example, of the leading 24 commodities, 16 (two-thirds) were not subject to discriminatory ad valorem duties. This is strongly suggestive of an MFN restraint effect on the commodities not traded, or traded at low levels (in 1975, the United States imported over 1,000 different commodities from the PRC, disaggregated at the seven-digit TSUS level). For the eight commodities subject only to specific tariffs, the potential impact of MFN extension was low: only about 2 percent of the value of these imports in 1975.

If MFN had been extended in 1975, the leading commodities which would have gained the most in absolute terms are: baskets, polyester cotton shirting, ABC sheeting, headwear, bamboo, and rattan articles, and men's and boy's cotton wearing apparel, NES.

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[13] Commodities with elasticities greater than −2.00 were defined as "highly price elastic;" those with elasticities between −2.00 and −1.00 were defined as "moderately price elastic;" and those with elasticities less than −1.00 were defined as "price inelastic."

[14] It has been suggested in the literature that least squares estimation is biased toward inelasticity, but this has not been settled. In any case, it is not our purpose to pursue that question here. See Leamer and Stern (1970), pp. 28-37.

The MFN impact for the leading commodities as a group is equal to about $6.1 million using the highest empirically calculated elasticities. Using a higher elasticity for apparel articles, the effect would have been about $9 million. These figures are about 4.9 percent and 7.2 percent respectively of the actual level of trade in these commodities in 1975.

2. Three Digit SITC Commodity Grouping—Results

As indicated above, this commodity grouping contained 31 products with significant ad valorem tariff differentials; in addition, 11 other products with no significant tariff differentials were included to broaden the coverage.

If in 1975 the PRC had achieved a level of market penetration in the United States for these 42 commodities equivalent to that achieved in the EC countries, total U.S. imports from the PRC would have been approximately $329 million. This is more than twice the level actually achieved ($150 million). Of the $329 million in projected U.S. imports, $221 million was the projected level for the 31 commodities subject to ad valorem tariff differentials, $104 million was the projected level for those not subject to tariff differentials, and the remainder was the projected level for all other commodities. Taking actual trade as a percentage of potential trade, the 11 commodities without ad valorem tariff differentials achieved 62 percent of the projected level while the commodities with significant tariff differentials achieved only about 37 percent of the projected level.

Calculating the impact of MFN extension for the 31 commodities as a group, using the largest (that is, most negative) empirically determined elasticities, the total increment at the projected level of trade for these commodities ($221 million) would have been approximately $82 million. This would have been a 25-percent increase over the total projected import level ($329 million) for all commodities and about 55 percent over the actual level.[15]

Products which would have gained the most by MFN extension at the projected level of trade were (in absolute terms): 899 (manufactured articles NES), 841 (clothing), 599 (chemical products, NES), 653 (textile fabrics, woven, not cotton), 851 (footwear), 894 (toys, games, sporting goods, et cetera), 666 (pottery), 656 (made up articles, textile materials, NES), 512 (organic chemicals).

Alternatively, instead of considering the tariff effects as incremental to the hypothetical level of trade, they could be considered to be partially or totally subsumed in the projected trade for the 31 commodities. Actual U.S. imports of these products were about $81 million in 1975. As an upper limit, the entire difference between the actual level and the projected level of U.S. imports of these products from the PRC could be ascribed to the lack of MFN; this amounted to approximately $140 million, which was about 43 percent of the total projected trade.

The differentials between column 1 and column 2 ad valorem equivalent duty rates ranged from 2.6 percent to 50.7 percent for the 31 commodities in this group. For seven commodities with tariff differentials of less than 10 percent, the average actual market penetration in 1975 was 62 percent of the actual trade. In comparison, for 12 products with tariff differentials exceeding 30 percent, the average actual imports were only 19 percent of the projected level.

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[15] Using a higher elasticity for apparel (SITC 841) would have increased the total increment by about $9.7 million to approximately $92 million. Using the lowest (non-zero) empirically determined elasticities, the total MFN effect was about $22.2 million.

3. Labor Impact—Results

The maximum number of workers that might be displaced, if our high estimates of the elasticities are correct, would be fewer than 5,773. If our low elasticity estimates are more nearly correct, the maximum number would be less than 1,631. This estimate is based on 1975 data and on our results for the 1975 estimated change in trade. The numbers vary by category depending on the estimated change in trade and the labor/output ratios, but the change might be largest in SITC categories 841, nonfur clothing; 851 footwear; 666, pottery; 831, travel goods, handbags, and similar articles; and 899, the catchall category of miscellaneous manufactures.

V. CONCLUSIONS

The following restates the principal conclusions of this study:

> The price elasticity of U.S. import demand for many of the types of products exported by the PRC is relatively low. Therefore, small changes in prices of these imported goods are likely to produce only limited consumer responses.
>
> A significant proportion of current PRC exports to the U.S. are not subject to ad valorem tariff differentials. Some are assessed only specific duties, and the impact of MFN extension for these commodities would be small.

Given the price inelasticity and number of products not subject to ad valorem tariff differentials, the impact of MFN extension on those products currently being traded would be limited—perhaps five to seven percent of the actual import level.

Lack of MFN appears to have a substantial impact on certain commodities exported by the PRC, principally light manufactures. These commodities are imported by the United States, but at disproportionately low levels compared to the EC market. If U.S. imports of PRC products had been "normalized" (that is, equivalent to EC imports), the impact of MFN extension in 1975 at the normalized level would have been about 55 percent of the actual level of trade. In 1975, the difference between the normalized import level and the actual level for commodities with ad valorem tariff differentials was approximately 90 percent of total imports. This suggests that the MFN impact in that year would have been between 50 and 90 percent of the actual value of imports.

In the future, the ratio of actual imports to "normalized" imports (however defined) can be expected to rise; eventually a plateau may be reached. As trade increases, the significance of the lack of MFN should also increase, both in absolute value terms and as a percentage of the shortfall between actual and "normalized" trade.

The effect of MFN extension on U.S. domestic employment is likely to be small—fewer than 6,000 workers under the most pessimistic estimates. The apparel and light manufacturing (toys, sports goods, et cetera) industries would be most affected.

TABLE 1.—MFN EXTENSION FOR LEADING UNITED STATES IMPORTS FROM PRC, 1975

TSUSA	Value (thousands)[1]	Ad valorem (percent)		MFN increment (high estimate) (thousands)	Alternative estimate for clothing[2]
		Col. 1	Col. 2		
Pt. I: Commodities with ad valorem duties:					
3202033	$11,888	9.51	17.00	$984	
3201038	7,321	7.61	13.50	777	
2224400	2,230	8.50	50.00	1,135	
3201058	1,889	7.61	13.50	125	
3802787	1,708	21.00	45.00	27	(1,328)
2224000	1,551	25.00	50.00	480	
4372400	1,533	5.00	25.00	73	
1861560	1,530	15.00	20.00	61	
7023780	1,358	10.00	25.00	281	
3803984	1,244	16.50	37.50	208	(879)
3202092	1,235	9.51	17.00	164	
3203032	1,178	11.41	20.50	116	
7021020	1,099	20.00	37.00	237	
1067500	1,019	10.00	20.00	6	
4528040	964	3.00	25.00	27	
3201026	861	7.61	13.50	90	
5173100	792		10.00	19	
3601500	745	11.00	45.00	148	
3800990	738	16.50	37.50	123	(522)
1861550	720	15.00	20.00	29	
3202058	674	9.51	17.00	56	
7003550	651	8.50	20.00	96	
2225700	632	8.00	40.00	122	
3802779	622	21.00	45.00	10	(484)
1861565	613	15.00	20.00	25	
222600	611	12.50	45.00	273	
2226400	520	5.00	25.00	153	
		Cents per pound			
Pt. II: Commodities with specific duties only:					
1863000	3,409	0.75	3	9.7	
6015400	2,227	25	50	131.8	
4175000	1,889	.3	2	16.3	
1703220	1,799	12.75	35	22.8	
6320200	1,498	1	2	0	
1618300	1,646	2.5	5	48.4	
1454400	745	Free	2	32.0	
3064293	658	12.5	25	22.8	

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[1] Source of data: Pt. I—U.S. Department of Commerce, "Schedule A Imports, Customs Valuation Series." Pt. II—U.S. Department of Commerce, "Schedule A Imports, Commodity by Country (FT 135)."

[2] Using price elasticity equals —3.92.

TABLE 2.—TRADE NORMALIZATION AND MFN EXTENSION FOR SELECTED 3-DIGIT SITC COMMODITIES EXPORTED BY THE PRC (1975 DATA)

[In million U.S. dollars]

SITC	United States					
	Actual trade[1]	Projected trade	Actual ÷ projected	Shortfall	High MFN effect[2]	Low MFN effect
051	0.9	1.18	0.7627	0.3	0	0
053	.3	2.17	.1382	1.9	.4	.2
075	3.0	3.10	.9677	.1	0	0
276	2.8	4.48	.6250	1.7	0	0
291	6.5	21.53	.3019	15.0	1.5	.7
292	1.1	5.51	.1996	4.4	.1	0
512	1.1	13.14	.0837	12.0	2.0	1.1
513	1.9	4.11	.4623	2.2	.4	.2
514	.2	.73	.2740	.5	.2	0
531		.30		.3	.1	0
541	2.1	1.47	1.4286		.1	0
551	2.5	5.56	.1511	3.1	.2	.1
599	4.5	10.05	.4478	5.6	9.2	8
651		.83		.8	.7	.3
652	27.4	13.61	2.0132		1.7	1.1
653	.2	9.61	.0208	9.4	5.3	2.7
655	1.8	2.97	.6061	1.2	1.2	0
656	1.7	3.19	.5329	1.5	4.6	.8
657	1.7	4.29	.3963	2.6	.8	.2
666	1.0	16.81	.0595	15.8	4.8	1.9
689	1.5	.59	2.5424		.1	0
697	.2	1.18	.1695	1.0	1.3	0
821	.5	4.11	.1217	3.6	1.0	.4
831	.2	4.74	.0422	4.5	1.6	1.0
841	8.8	16.82	.5232	8.0	[4] 10.0(19.7)	4.3
851	1.2	22.75	.0527	21.55	4.9	2.
864		3.25		3.3	.7	.3
891	.4	2.03	.1970	1.6	1.3	0
894	.2	12.13	.0165	11.9	4.9	2.0
897	.7	4.59	.1525	3.9	1.0	0
899	6.9	24.08	.2865	17.2	21.8	1.8
Total	81.3	220.88	.3681	139.6	81.8	22.2

[1] Source of data: OECD, series B imports, 1974.

[2] Using the highest (most negative) empirically calculated elasticities.

[3] Using the lowest (nonzero) empirically calculated elasticities.

[4] The following elasticity was used to calculate this figure: —3.92

TABLE 3.—PRICE ELASTICITIES OF IMPORT DEMAND FOR SELECTED COMMODITIES

Schedule A [1]	$	Specification	Schedule A [1]	$	Specification
0119040	−0.06	1-T	6575010	−.65	2-T
0517150	−1.49	2-A	6664020	−.50	2-T
0751040	−.52	2-A	6664040	−1.05	2-A
1210030	−.05	1-T	6665020	−.64	2-A
2623010	−.65	2-A	8411532	−.87	2-T
2762240	−.24	2-A	8411562	−.28	2-T
2839200	−.58	1-T	8414312	−1.99	2-T
2919200	−.67	2-A	8414480	−1.82	2-T
2919640	−.92	1-T	8510242	−1.39	2-T
5137220	−.98	2-A	8510243	−.94	2-T
5414040	−.25	2-T	8510248	−.80	2-T
5511080	−.13	1-T	8942615	−.89	2-T
6521533	−1.21	2-A	8942620	−1.40	2-T
6521538	−1.94	2-A	8971520	−.50	2-T
6557290	−1.52	2-T	8972932	−.14	2-T
6895020	−.39	2-A	8992420	−1.57	1-A
8411116	−.93	1-T	8994100	−.64	2-T
8411365	−.08	2-A	8995240	−2.73	2-A
8992330	−1.33	1-T	5310040	−1.24	1-A
8992240	−1.55	1-A	5995830	−1.89	2-A
0517210	−1.13	1-T	5996400	−5.48	1-A
0538030	−1.53	1-A	6510160	−2.53	2-A
0616000	−1.45	2-T	6531520	−1.75	2-T
2924020	−.25	1-A	8210820	−.81	2-T
5120200	−.89	1-T	8310030	−1.43	2-A
5120320	−.51	2-A	8642740	−.82	1-A
5140120	−2.39	2-A	8641110	−.82	2-T
6569135	−3.93	1-A	8911180	−2.45	2-A
6569168	−.65	1-A	8914240	−1.50	2-A

[1] Schedule A, Statistical Classification of Commodities Imported into the United States (based on the Standard International Trade Classification—SITC), compiled by the U.S. Department of Commerce, Bureau of the Census.

Specifications: 1-T: Estimating equation using price ratio only; total U.S. imports of commodity. 1-A: Estimating equation using price ratio only; U.S. imports from analog country. 2-T: Estimating equation using price ratio and GNP; otal U.S. imports of commodity. 2-A: Estimating equation using price ratio and GNP; U.S. imports from nalog country.

TABLE 4.—AD VALOREM TARIFF EQUIVALENTS FOR 3-DIGIT SITC COMMODITIES IN UNITED STATES-PEOPLES REPUBLIC OF CHINA

SITC No.	Description	Duty (in percent) Col. 1	Duty (in percent) Col. 2
051	Fruits—fresh; nuts—fresh or dried	2.2	4.8
053	Fruits and nuts—prepared or preserved	7.2	19.4
075	Spices	1.1	3.7
276	Crude minerals, n.e.s	1.0	4.4
291	Animal materials, n.e.s., crude	4.1	11.9
292	Vegetable material, n.e.s., crude	1.8	5.6
512	Organic chemicals	6.3	24.5
513	Inorganic chemical elements, oxides, etc	3.1	12.3
514	Inorganic chemicals, except elements, oxides	3.6	14.2
531	Synthetic organic dyestuffs, etc	15.7	36.7
541	Medicinal and pharmaceutical products	4.4	20.0
551	Essentai oils	4.3	31.3
599	Chemical products and materials, n.e.s	6.9	24.8
[1] 651	Textile yarn and thread	10.5	45.0
[1] 652	Cotton fabrics—woven	8.7	15.7
653	Textile fabrics—woven, other than cotton	21.2	59.0
655	Special textile fabrics and related	12.2	41.9
656	Made-up articles, textile materials, n.e.s	18.2	61.9
659	Floor coverings, tapestries, etc	13.2	47.4
666	Pottery	20.1	52.9
689	Base metals and alloys, n.e.s	7.5	32.8
697	Household equipment of base metal	7.0	39.0
821	Furniture	12.5	46.0
831	Travel goods, handbags, etc	21.5	50.8
[1] 841	Clothing and accessories	21.8	58.2
851	Footwear	10.4	27.4
864	Watches and clocks, includes parts	11.1	41.8
891	Sound recorders, musical instruments, etc	7.0	35.4
895	Toys, games, sporting goods, etc	10.0	41.5
897	Jewelry and related articles	16.3	67.0
899	Manufactured articles, n.e.s	13.0	50.5

[1] Commodities were calculated as follows: 651—Ad valorem equivalent for SITC 6511, from Whisler (1977). 652—Weighted average ad valorem equivalent based on U.S. actual imports from PRC in 1975. 841—Weighted average of 5-digit SITC ad valorem equivalents, from Whisler (1977).

Methodology: Ad valorem equivalents are unweighted averages of all 7-digit TSUS commodities within the 3-digit groups (goods admitted duty-free also included). Source was "Tariff Schedules of the United States Annotated (1976)". Tariffs applicable only to Canada were omitted. The 7-digit TSUS commodities were aggregated into 3-digit SITC groupings using the definitions in U.S. Department of Commerce, Bureau of the Census, "U.S. Foreign Trade Statistics Classifications and Cross-Classifications, 1974."

TABLE 5.—POTENTIAL IMPACT OF MFN ON U.S. DOMESTIC EMPLOYMENT

SITC category	Maximum potential reduction in number of jobs		Labor/output ratios [1]
	Low estimates	High estimates	
051	2	4	78
053	16	29	78
075	0	0	80
276	0	0	37
291	29	59	40
292	0	3	50
512	48	84	42
513	5	9	26
514	0	4	20
531	0	1	25
541	2	2	35
551	2	4	22
599	20	228	25
651	14	35	54
652	69	111	65
653	165	324	62
655	0	81	68
656	57	345	75
657	13	53	63
666	180	461	96
689	1	2	28
697	0	64	50
821	33	85	86
831	95	444	99
841	439	1,027	103
851	183	392	80
864	24	58	78
891	0	71	54
894	110	266	55
897	0	59	59
899	124	1,468	67
Total	1,631	5,773	

[1] Number of workers per million 1975 dollars of output, given 1975 productivity.

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APPENDIX A. SOME NOTES ON PREVIOUS STUDIES MEASURING MFN EXTENSION FOR COUNTRIES OTHER THAN CHINA

THE COMPARATIVE MARKET APPROACH

Most of the previous work on extending MFN tariff treatment has focused on the Soviet Union and Eastern European countries. Furthermore, only a few studies have attempted to measure quantitatively the impact that MFN extension would have on trade levels. Most of these studies have used a "comparative market," or "market shares," technique. In brief, the comparative market approach typically involves a two step methodology: (1) determining a "normalized" level of U.S. imports from the potential MFN recipient country—i.e., the level which imports would reach in the (hypothetical) absence of all factors constraining trade, including discriminatory tariffs; and (2) separating the effects of the restrictive tariffs from all the other constraints on the recipient country's exports to the U.S.

In order to determine the hypothetical U.S. import level under full trade normalization typically a comparable or "reference" market is chosen as a proxy for the U.S. market. The reference market may be a single country or a group of countries. The reference market should in principle be one which does not impose discriminatory tariffs or other restrictions on the centrally planned economy's (CPE's) products. In fact, however, many of the countries used as reference markets, e.g., western developed countries, do maintain special restrictions toward CPE's, particularly quotas. If the United States is included in a reference market consisting of a group of countries, this will impose a downward bias on the final estimates of normalized U.S. trade.

The CPE's share of the reference market is calculated for various products at the desired level of disaggregation. The "reference supplier" to the reference market would normally be the world, but could also be limited in some way, e.g., by including only countries with exports presumed similar to the potential MFN recipient country.

After the reference market and suppliers are defined, U.S. normalized imports from the CPE can be calculated. For example, an assumption could be made that after normalization the potential MFN recipient's share of the U.S. market for a particular product would be the same as the recipient's share of the reference market.

Once the normalized level of imports has been determined, the tariff restrictions must be separated from the nontariff barriers as causative factors for the divergence between the normalized and actual trade levels. The comparative market approach takes advantage of the fact that for countries not enjoying MFN tariff treatment there are, nevertheless, some products for which the tariff differential is nonexistent or insignificant. The difference between normalized and actual trade for these products in the U.S. market can therefore be ascribed entirely to nontariff barriers. A weighted or unweighted average ratio for all such commodities can be calculated. This ratio can then be extrapolated to commodities for which there is a significant differential between the MFN and non-MFN rates. The product of this ratio and the difference between normalized and actual trade is the value of the non-tariff barriers; the residual is the MFN effect.

PROBLEMS WITH THE COMPARATIVE MARKET APPROACH

(1) The assumption that a reference market (country or group of countries) can be found with import demand structure fundamentally analogous to the United States market is, of course, one which is unlikely to be met in reality.

(2) Under the U.S. tariff structure, raw materials and semi-manufactures tend to have relatively lower tariffs, and lower tariff differentials, than manufactures. The assumption that the non-tariff barriers will have a similar impact on commodities both with and without significant tariff differentials imparts an uncertain degree of bias to the results. The nontariff barriers may be different in kind, as well as higher, for manufactured products. Furthermore, as a given CPE gains experience in trading with the United States, the non-tariff barriers can be expected to gradually decrease. This phenomenon may be more pronounced for raw materials and semi-manufactures than for manufactured products.

(3) If the ratio of U.S. imports from a given CPE to total U.S. imports of the commodity is equal to or greater than the comparable ratio for the reference market's imports from the CPE, this implies that the extension of MFN tariff treatment would have no impact on U.S. imports of that commodity from the CPE. This obvious anomaly highlights the central problem with the comparative market approach: it attempts to measure what is essentially a price phenomenon by using indirect means and employing relatively crude assumptions.

(4) Because of the changing nature of the non-tariff barriers the market shares ratios would need to be recalculated as new data become available. The comparative market technique may be more useful for *ex post facto* examination of trade data than for forecasting. In order to forecast the impact of tariff extension in future time periods, predicted changes in import demand in the reference market would have to be taken into account.

WORK ON THE SOVIET UNION AND EASTERN EUROPE

A number of studies have dealt with the question of extending MFN tariff treatment to the centrally planned economies of the USSR and Eastern Europe. Wolf[1] has written an excellent review of the literature pertaining to general quantitative work on tariff and non-tariff barriers in East-West trade, so only two studies are examined here; one because it is a recent and relatively straightforward use of the comparative market approach and the other because it uses import demand structure to analyze MFN tariff effects.

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[1] Thomas A. Wolf, "The Impact of Formal Western Restraints on East-West Trade: An Assessment of Existing Quantitative Research," in Hardt, John P., *Tariff, Legal and Credit Constraints on East-West Commercial Relations*, pp. 27-55, Ottawa, Canada: Carleton University Institute of Soviet and East European Studies, 1975.

Elias and Searing [2] used comparative market techniques to estimate the effects of U.S. tariff and non-tariff barriers on trade with the USSR and five Eastern European countries during the period 1966–71. They also estimated "normalized" trade levels for 1976 and 1980 under the assumption that these barriers were fully removed.

The Elias and Searing study made two estimates of the MFN tariff effect using two reference markets: (1) Canada and (2) the 1966 members of the European Community plus the United Kingdom. Elias and Searing apparently used two digit SITC commodity groupings and examined some commodities within these groups at a more disaggregated level. They utilized the degree of market penetration achieved by the U.S.S.R. and Eastern European countries in the reference markets to calculate the "normalized" level of U.S. imports from these countries. A number of adjustments were made in the data in order "to reflect a commonsense appraisal of economic realities." For example, EC imports of some agricultural products seemed higher than the U.S. market could reasonably be expected to import from these countries. Similarly, for a number of products, the CPE share of the Canadian market seemed larger than would be feasible for the United States, perhaps due to the relatively small size of the Canadian market. Actual U.S. imports from the CPE countries were subtracted from "normalized" imports to determine the loss in trade caused by the various tariff and non-tariff restraints. The restrictive effect of the lack of MFN tariff treatment was separated from the non-tariff barriers by determining the portion of imports in each commodity group which suffered significant tariff discrimination (more than five percent difference between the MFN and non-MFN ad valorem rates). These proportions were then multiplied by the estimates of the total costs of all barriers to U.S. imports from the Socialist countries to obtain dollar estimates of the CPE export losses stemming from U.S. MFN denial.

For most of the countries studied, lack of MFN tariff treatment accounted for the largest portion of the shortfall between actual and potential trade in 1966 and 1971. Taking the calculated shortfall of imports caused by the tariff differential as a proportion of actual imports, the Elias and Searing findings can be summarized as follows:

[In percent]

	1966 estimate		1971 estimate	
	Low	High	Low	High
U.S.S.R. and European Economic countries as a group	20	30	43	46
Individual countries (range)	7–49	14–65	25–58	21–69

A study by Wolf [3] attempted to measure two effects on U.S. imports from the USSR and seven East European countries [4] which result from MFN extension. The two effects caused by lowering the price of the CPE product in the U.S. domestic market by the amount of the tariff change are: substitution of the CPE good for domestic goods, and substitution of the CPE good for competing imports.

The commodity data used in this study were disaggregated to the two-digit SITC level. The *ad valorem* tariff equivalents used in this study were based, for the most part, on the composition of U.S. imports in 1960 and therefore did not fully take into account reductions in Column 1 tariff rates between 1962 and 1968—thereby understimating the import expansion effect to some extent.

In order to measure the substitution effect of CPE products for U.S. domestically produced products, Wolf used estimates of U.S. price elasticity of demand for five major commodity groups prepared by Houthakker and Magee.[5] There is a question, which Wolf notes, as to the suitability of applying these elasticities, which were estimated for broad product classifications, to two digit subgroups within the broader categories.

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[2] Elias and Searing (1974).

[3] Wolf, Thomas A., *The Quantitative Impact of Liberalization of United States Unilateral Restrictions on Trade with the Socialist Countries of Eastern Europe*, Department of State, External Research Study XR/RECS-3, Washington, D.C.: 1972.

[4] Poland was included in Wolf's study despite the fact that its products already enjoyed MFN treatment in the United States.

Wolf introduced a supply constraint into his estimating equation. The supply variable took two values, depending on the rate of growth of OECD imports of the commodity in question from the CPE's. For commodities with OECD import growth rates in the lowest quartile, Wolf in effect assumed that there was a supply constraint and that if MFN were extended the CPE's export price would rise by the full amount of the tariff reduction, thereby offsetting it. For the other commodities it was assumed that the CPE country's export price would remain the same after MFN extension so that the U.S. domestic price would decrease by the full amount of the tariff reduction.

Wolf did not try to measure the substitution effect of CPE imports for non-CPE imports directly because of the unavailability of elasticity of substitution estimates. Instead he devised a four-part criterion to identify product groups with a "substantial potential" for substitution among foreign suppliers. The criterion was based on his analysis of the relative share of CPE products in total U.S. and OECD imports in 1968. The four tests identified: (1) products with a large differential between the Eastern European market share in the reference (OECD) market and the U.S. market share; (2) products with a relatively more rapid annual import growth rate to the reference market; (3) products with a relatively large tariff differential between the column 1 and column 2 rates; and (4) products from Eastern European countries not subject to high transport costs. This four-part test reduced the number of two digit groups to ten. For these commodities, it was assumed that when the comparative static effects of trade liberalization were fully realized, the U.S. market share from the CPE's would equal the OECD countries share (excluding the United States) from the CPE's.

The principal problem with the Wolf study is that it was based on actual trade; no attempt was made to estimate potential imports which were essentially barred by the higher rates but which would be traded if the tariff differential were removed.

APPENDIX B. SURVEY OF PREVIOUS STUDIES OF MFN EXTENSION TO CHINA

We are aware of six previous papers which have examined various aspects of the question of extending MFN tariff treatment to the P.R.C. Only one of these reached a quantitative estimate of the impact of MFN extension on U.S. trade levels. None attempted to measure the price effects of MFN extension. This appendix briefly summarizes the existing literature on this subject.

CAHILL[1]

Cahill, in a study published in 1973, examined approximately 180 commodities disaggregated at the seven-digit TSUSA classification level. The commodities selected were those currently exported by the P.R.C. and "having a sales potential in the United States."[2] Cahill's study is entirely descriptive. The products are arranged in broad commodity groupings and there is a narrative about each grouping. The 1972 MFN and non-MFN tariff rates and the 1972 U.S. imports from leading Asian suppliers are included for each commodity.

WHISLER[3]

A recent study by Janet Whisler examines PRC exports in 1973 and 1974 to 13 industrialized countries (the reference market) and the United States. This study, which is primarily descriptive, utilizes 227 currently traded commodities, at the five digit SITC level, with some three and four digit groupings. Two comparisons are made: (1) The PRC share of total U.S. imports of each commodity with the PRC share of the combined imports from the reference market, i.e., the other 13 countries); and (2) the U.S. share of the 14 countries' (including the United States) imports from the PRC with the U.S. share of their imports from the world. Whisler notes that the two sets of ratios are "highly correlated . . . [and] correspond too closely to expect that one will add to an understanding of the tariff-trade relationship in ways which the other one does not.[4] (The high level of correlation is due to the low level of U.S. imports from the PRC.) Therefore, she relies primarily on the latter ratio. In order to obtain a qualitative sense of the impact of tariff differentials on trade levels, she arranges the commodities in four different groupings: (1) the 50 leading commodities imported by the United States from the PRC; (2) the 50 leading commodities imported by the 13 other industrialized countries from the PRC; (3) the 50 commodities with the greatest U.S. tariff differential; (4) commodities for which the U.S. tariff differential is less than five percentage points.

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[5] H. S. Houthakker and S. P. Magee, "Income and Price Elasticities in World Trade," *Review of Economics and Statistics*, May 1969. The commodity groups were crude foodstuffs, manufactured foods, crude materials, semi-manufactures, and manufactures.

[1] Harry A. Cahill, *The China Trade and U.S. Tariffs*, New York: Praeger, 1973.

[2] *Ibid*, p. 79.

[3] Janet Whisler, "Special Report to the Congress and the East-West Foreign Trade Board on Implications for U.S. Trade of Granting Most-Favored-Nation Treatment to the People's Republic of China." United States International Trade Commission Publication 816, Washington, D.C., May 1977.

In general, the study found that U.S. imports from the PRC in 1973–1974 were low compared to the reference market, even for those commodities with a zero or negligible tariff differential. Although the study did find a tendency for the United States to import less or none of the products with the greatest difference between the column 1 and 2 duty rates (textiles being an exception), there was no direct relationship between tariff differentials and the corresponding level of imports. For example, 26 of the other industrial countries' leading imports were also among the 50 leading U.S. imports. Comparing the tariff differentials for these 26 products with the 24 products not in the U.S. top 50:

FIFTY LEADING IMPORTS OF THIRTEEN INDUSTRIALIZED COUNTRIES

Tariff differential (percent)	Included in U.S. top 50	Not included in U.S. top 50
0 to 4.9	6	5
5 to 14	9	5
19.2 to 42.2	11	10
42.8 to 52.7		4

Furthermore, twelve of the 50 leading U.S. imports are in the high tariff group (over 31.9 percent tariff differential) while 11 of the 50 leading U.S. imports have insignificant or zero tariff differentials. From this and other evidence, Whisler's study concludes that, in general, the PRC may be encouraging export of products which have traditionally been successful in foreign markets, without regard to U.S. duties. While the PRC world exports include a large number of products for which U.S. demand is negligible, there are still—according to Whisler—important U.S. markets which the PRC has not fully exploited.

The strong points of this study are its comprehensive product coverage; the use of current U.S. rates of duty and the careful calculation of ad valorem tariff equivalents; and the use of a procedure for eliminating products with little U.S. demand potential.

A shortcoming is the failure to make a systematic attempt to measure the impact of MFN extension. Since there is no consideration of the elasticity of U.S. import demand for Chinese products, it is possible to conclude, *inter alia*, that the products currently being imported either already enjoy low tariffs or are not notably responsive to price changes.

Haas[5]

The only study to date which includes a quantitative estimate of the impact on U.S. trade of MFN tariff extension to the PRC is one by Steven Haas. Haas, using data for 1972, examined 106 commodities (at the five to seven digit SITC level) imported by the United States as well as by his reference markets—the United Kingdom and the Federal Republic of Germany. Using the market shares approach Haas calculated the PRC proportion of total imports of each commodity imported by each of the three countries. He assumed that if U.S.-PRC trade were fully normalized the highest ratio would apply. In order to separate the tariff effects from the other factors influencing trade, Haas divided the commodities into two groups—those with a negligible tariff differential (defined as less than 15 percent) and all other commodities, for which the differential is presumed to be significant. Taking the commodities with an insignificant tariff differential as a group Haas calculated the average PRC market share for these commodities in each of the three countries. These ratios were taken as an indication of the level of development of each country's trade with the PRC, irrespective of tariffs. He then divided the UK and FRG ratios by the degree of nontariff-related normalization in the trade, using these new ratios to adjust for the U.S. ratio. Haas calculated what the U.S. imports of each commodity with a significant (over 15 percent) tariff differential would be if U.S. imports from the PRC as a proportion of U.S. imports from the world were equivalent to the corresponding ratio for the FRG or UK (whichever ratio was higher). Summing over all increments, Haas concluded that U.S. imports from the PRC in 1972 would have been 16 percent higher if the PRC had enjoyed MFN tariff treatment in that year.

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[4] Whisler, p. 15.

[5] Haas, Steven, "Impact of Extension of Most-Favored-Nation Tariff Treatment to U.S. imports from the People's Republic of China," in *Johns Hopkins SAIS Review*, Vol. 18, No. 1 (fall 1973), pp. 20–24.

The principal weaknesses of the Haas study relate to the fact that he presumed that the average market penetration ratios for the low tariff differential products as a group would apply *ceteris paribus* to the individual commodities with high tariff differentials. Furthermore, the assumption of basic similarity between the U.S. market and the British and German is, of course, problematical.

JELACIC [6]

Jelacic was not exclusively concerned with the PRC. He was attempting to measure the MFN impact on trade flows between the USSR, Eastern Europe, and the PRC on one hand and 12 developed economies on the other. He assumed that a country's potential export supply as well as its import demand depended primarily on its economic size, as measured by Gross National Product (GNP).

Jelacic used two models to measure the impact of MFN tariff treatment and other determinants of trade flows.[7] The first was a "general equilibrium deterministic" model with the value of trade between the ith (Communist) and the jth (developed) market as the dependent variable and the following independent variables: GNP of the two countries; ocean shipping distance; population; and dummy variables for extension or lack of MFN tariff treatment and whether or not the two countries are adjacent. Jelacic regressed various combinations of dependent variables on the independent variable. (The variables were in log linear form.) For all of the specifications, the coefficient of the MFN dummy variable was positive, and statistically significant. It ranged in value from about 12.8 percent to 18.9 percent of the developed market imports from the Communist countries. Jelacic's second model was a "probability" model. The dependent variable was the same as the first model. The independent variables were ocean shipping distance, MFN (dummy), and a variable to indicate the probable size of the trade flow between countries i and j if the trade were randomly distributed (*i.e.*, the probability of a transaction flow between countries i and j was equal to the product of two ratios: the value of country j's imports as a proportion of world trade and the value of country i's exports as a proportion of world trade). The estimating equation was also expressed in log linear form. In both regressions with this specification the MFN variable was statistically not significant; in one, it also had the wrong sign.

The Jelacic models yield little useful information about the impact of MFN tariff extension on individual commodities and countries. Wolf[8] notes, in addition, that of the 107 observations used in Jelacic's model, only 12 were cases of lack of MFN tariff treatment and eight involved the U.S. and a Communist trading partner. Thus, Wolf argued that Jelacic might not be measuring the existence or lack of MFN, but actually the characteristics of the U.S. import market, including other restraining factors besides discriminatory duties. Also, Wolf notes that Jelacic's quantitive estimatesof the restrictive MFN effect may have a serious downward bias because of his failure to take into account the quota restrictions many of the developed countries maintain against products from the Communist countries.

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[6] Jelacic, John E., *Impact of Granting Most Favored Nation Treatment to the Countries of Eastern Europe and the People's Republic of China*, United States Tariff Commission Staff Research Study No. 6, Washington: USTC, 1974.

[7] The study is based on East-West trade patterns in 1971.

[8] Wolf, Thomas A., "The Impact of Formal Western Restraints on East-West Trade: An Assessment of Existing Quantitative Research," in Hardt, John P., *Tariff, Legal and Credit Constraints on East-West Commercial Relations*, pp. 27–55, Ottawa, Canada: Carleton University Institute of Soviet East European Studies, 1975.

UNPUBLISHED WORK

Two unpublished studies estimate "normalized" US-PRC trade and propose comparative market methodologies for estimating the impact of extending MFN. Neither, however, actually calculates the MFN effect.

David Denny[9] in an unpublished 1973 study proposes that with full trade normalization, the U.S. share of PRC exports to 24 developed countries should be the same as the U.S. share of other Asian developing countries' exports to the same 24 countries. That is,

$$\frac{X_{\text{PRC-US}}}{X_{\text{PRC-Industrial world}}}=\frac{X_{\text{Other Asia-US}}}{X_{\text{Other Asia-Industrial World}}}$$

The advantages of using other Asian countries as the reference suppliers are that the PRC and many of these countries are at approximately the same level of economic development, export similar products, and share similar transport costs to the United States. Denny suggests that the commodities he studied, disaggregated to the four-digit SITC level, be divided into categories according to whether the tariff differential is "negligible," "moderate," or "extreme." For all products with "negligible" tariff differentials, the normalized level of PRC exports to the United States ($X'_{\text{US-PRC}}$) is calculated

$$X'_{\text{US-PRC}}=\left[X_{\text{Other Asia-US}}-\frac{X_{\text{PRC-Industrial World}}}{X_{\text{Other Asia-Ind. World}}}\right]$$

Then for each ith product with a "non-negligible" tariff differential, the MFN effect on PRC export levels to the United States is

$$\Delta X_{\text{US-PRC(MFN)}}=\frac{X_{\text{US-PRC}}}{X_{\text{US-PRC}}}\left[\left(X^{i}_{\text{US-Other Asia}}\,\frac{X^{i}_{\text{Ind. World}}}{X^{i}_{\text{Ind. World-Other Asia}}}\right)-X_{\text{US-PRC}}\right]$$

Nai-Ruenn Chen's approach[10] is essentially similar. He suggests that with full trade normalization, the PRC share of total U.S. imports should equal the PRC share of world imports, that is,

$$\frac{X_{\text{PRC-US}}}{X_{\text{World-US}}}=\frac{X_{\text{PRC-World}}}{X_{\text{World-World}}}$$

He is suggesting that PRC exports to the various industrialized countries are apportioned by country according to each (developed) market's proportion of total imports of all the industrialized countries.

Chen's proposed methodology for isolating the effect of lack of MFN tariff treatment is the same as Denny's.

Both Denny's and Chen's methodologies assume a fixed Chinese export supply Thus, a hypothetical increase in PRC exports to the United States due to MFN tariff extension implies a reallocation of exports among the PRC's other markets rather than any absolute increase in Chinese exports.

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[9] Denny, David L., "The Effect of Normalized Commercial Relations on PRC Exports to the U.S.," U.S. Department of Commerce, Bureau of East-West Trade, Washington, D.C., November 1, 1973.

[10] Chen, Nai-Ruenn, "A Probabilistic Approach to the Study of U.S.-PRC Trade," U.S. Department of Commerce, Washington, D.C., October 1, 1973.

THE IMPACT OF U.S. MOST-FAVORED-NATION TARIFF TREATMENT ON PRC EXPORTS

By Helen Raffel, Robert E. Teal, and Cheryl McQueen

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1. Introduction and Summary

This paper presents estimates of the amounts by which U.S. imports from the PRC would have exceeded their actual 1976 values had PRC products been assessed at U.S. most-favored-nation (MFN) tariff rates in that year. Our estimates are derived from a detailed econometric analysis of the tariff sensitivity of China's top 50 1976 hard-currency-earning exports, on a product-by-product basis. Because we do not expect that the product composition of China's overall hard currency export capabilities will alter rapidly in the near term,[1] we believe that the 30-percent MFN-induced rise in total U.S. imports from the PRC predicted by this model may be taken as applicable to the near future, should the United States grant MFN to China during the next few years. The analysis of which products are likely to show the largest increases in exports to the United States should also be relevant for a number of years to come.

Our estimates of the impact of MFN were derived from a cross-sectional multivariate regression model of the relative shares in specific product imports[2] from the PRC of 19 hard currency areas (actually, 20 political units, Belgium and Luxembourg together constituting a customs union: the 20 importers will hereafter be called "The Twenty").[3] For each product, the share of each importing area was assumed to be explicitly dependent upon several variables, among them the tariff it raises against the particular product coming from the PRC. After the parameters of the regression relationship for a given product were estimated from actual data for The Twenty, the U.S. MFN rate, along with the U.S. values of the other independent variables, was inserted into the estimating equation and the revised U.S. share calculated.[4]

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[1] See the article by Kravalis, elsewhere in this volume, for in-depth discussion of China's export capabilities.

[2] The products are the 1976 top 50 PRC hard currency exports at the 4- to 5-digit SITC level. SITC is the standard international trade classification nomenclature used by the United Nations. The highest level of disaggregation is the 4-digit level for some types of products and the 5-digit level for others. Successive digits added to a given numerical code signify successive subcategories of the class with the same initial digits. There are a total of 56 2-digit divisions, subdivided down to 1,312 items at the 4- to 5-digit level.

[3] "The Twenty" are: Australia. Austria, Belgium, Canada, Denmark, the Federal Republic of Germany, France, Hong Kong, Indonesia, Italy, Japan, Luxembourg, Malaysia, the Netherlands, Norway, Singapore, Sweden, Switzerland, the United Kingdom and the United States.

The results are shown in table 1 of section 3. They indicate that U.S. imports from the PRC would have been about 30-percent higher than the actual 1976 value of $202 million had China enjoyed MFN status. Increases would have occurred primarily among the following product groups, in the order given: household linens, basketwork, silk fabrics, medicaments, porcelain and chinaware, underwear, cotton fabrics, and dried vegetables.

Although it is not known whether China would seek generalized system of preferences (GSP)[5] status from the United States, we nevertheless inserted the still lower tariff rates associated with GSP into the relevant equations and calculated the effect of GSP on U.S. imports. The result was an estimated 34-percent rise in 1976 imports, not much larger than the MFN effect alone. The principal beneficiary of GSP would have been basketwork, followed, in absolute size of increase over the MFN effect, by medicaments and preserved fruit and nuts.

It should also be mentioned that the PRC (along with the Soviet Union) still suffers from an absolute U.S. ban on seven types of fur-skins. Because no other country invokes this ban, we were unable to statistically determine its quantitative impact. But since weasel and kolinsky (mink) are major PRC exports, we would expect that the removal of the ban would lead to significant U.S. fur-skin imports.

The estimated values of U.S. import responses to MFN and GSP presented in this paper may be biased downward. This is because the entire MFN-induced increase in imports is in each instance solely that attributed to a hard-currency-maximizing redirection of trade flows among the importing areas. Such an MFN-induced reaction would certainly benefit the PRC by augmenting its net hard currency earnings from a given total of exports, and its import capabilities would thereby be strengthened. If, in the longer run, the enhanced profitability of selling in the U.S. market should induce China to raise its total hard currency exports above what they otherwise would have been, and/or to change its export mix to favor those products which would benefit most from U.S. MFN, exports to the United States could be greater. (See section 4 for further discussion of this point.)

Finally, our results indicate that the geographical distribution of PRC exports is more tariff-sensitive than has sometimes been suggested.[6] There were, however, some notable exceptions. The greatest surprise was that none of the textile outergarment items showed statistically significant tariff sensitivity, although both of the underwear items and all of the fabrics did. On the other hand, distance from the PRC was a highly significant explanatory variable for the distribution of outergarments, and this suggests a tentative reason for the outergarment anomaly with regard to tariffs. If distance is a proxy for, among other things, cultural relatedness, then it may be that the style and quality of Chinese clothing (apart from underwear) is still too culture-bound to be widely acceptable far from the areas of traditional trade and large overseas Chinese populations.[7]

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[4] For a more detailed description of the model and the calculating procedure, see section 2. For a discussion of the derivation of the model used in this paper, a comparison with other models heretofore used to evaluate MFN impact, and an application of the model to Eastern European countries and the U.S.S.R., see Raffel, Rubin, and Teal, "The MFN Impact on U.S. Imports from Eastern Europe" in John P. Hardt, ed., *East European Economies Post-Helsinki*, Joint Economic Committee of Congress (Aug. 25, 1977) pp. 1396-1427.

[5] Under the GSP system of tariffs, which came into effect on January 1, 1976, zero tariff rates are assessed on a specified list of products imported by the United States from those countries which have been accorded "developing country" status by Presidential designation.

Distance from the PRC was a highly significant variable in all but two of our equations, and this strong relationship was evidenced both with and without the inclusion of Hong Kong. In a previous study of the MFN impact on the East European countries and the U.S.S.R.,[8] distance was rarely a significant variable. As we have suggested, it may be that the generally strong inverse relationship between sales and distance of purchaser indicates that China is still relatively inhibited on the world economic scene by cultural isolation.

2. Estimation of MFN and GSP Impact

A. The Model

The model used in this paper is identical with the model developed for an earlier paper in which the estimated effects of MFN on U.S. imports from various Eastern European countries were presented.[9] The relative shares of 19 importing areas ("The Twenty")[10] are here estimated for a selected group of PRC export products. For each product, the share of each importing area is assumed to depend upon (1) its share in total world exports of that product to The Twenty, (2) the tariff rate raised by the importing area against the given product from the PRC, (3) the presence or absence of quantitative restrictions (QRs) on that product specifically directed against the PRC, and (4) the distance between the importing area and the PRC (both air and maritime distances were used, alternatively).

Four forms of the relationship were tested, two linear and two log linear. The theoretically preferred form of each pair imposed a coefficient of unity upon the share from the world,[11] and in most cases where the best fit equation did not meet this condition the coefficient was close to unity. Our estimating equations were:

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[6] An International Trade Commission study, *Implications for U.S. Trade of Granting Most-Favored Nation Tariff Treatment to the People's Republic of China* (May 1977), concluded that the product mix of PRC exports to the United States was not highly correlated with U.S. tariff differentials between the non-MFN and MFN rates. This may be true, but it does not follow from this fact alone that MFN would have little impact. Whether a product will be shipped to a specific market depends, among other things, upon the actual tariff rate in that market and upon the size of that tariff rate relative to the rates assessed in other world markets in which the product might instead be sold. The economic profitability calculation will not depend upon a comparison of the actual tariff rate with a hypothetical, unavailable alternative.

The model presented in this paper attempts to estimate PRC exports to various world markets as a function of the actual tariff rates in those markets. Since, of the products tested, a large proportion in fact proved to be tariff-sensitive, and, of these, the value of PRC exports to the United States predicted by the regression parameters were generally very close to the actual values, we conclude that the PRC is not careless of tariff rates in making its export decisions. Nevertheless, we also conclude on the basis of our quantitative estimates that the increment in PRC exports to the United States consequent upon the receipt of MFN would not be large.

[7] Dr. Nai-Ruenn Chen suggested to us that the overseas Chinese populations of The Twenty might be a significant explanatory variable for some of our products, but we were unable to obtain the data.

[8] See footnote 4 for reference.

[9] See footnote 4.

[10] These 19 importing areas—"The Twenty" political units—are itemized in footnote 3. Belgium and Luxembourg together comprise a single importing area, hence the total number of observations for regression is 19.

[11] See footnote 18 of Raffel, Rubin, and Teal, *op. cit.*

(2.1) $CS_{ip}=A_o+A_1WS_{ip}+A_2D_i+A_3(1+t_{ip})+A_4QR_{ip}$
(2.2) $CS_{ip}-WS_{ip}=A_o+A_2D_i+A_3(1+t_{ip})+A_4QR_{ip}$
(2.3) $LnCS_{ip}=A_o+A_1LnWS_{ip}+A_2LnD_i+A_3Ln(1+t_{ip})+A_4LnQR_{ip}$
(2.4) $LnCS_{ip}-LnWS_{ip}=A_o+A_2LnD_i+A_3Ln(1+t_{ip})+A_4LnQR_{ip}$

CS_{ip}=fractional share of importing area i in PRC exports of product p to The Twenty;
WS_{ip}=fractional share of importing area i in world exports of product p to The Twenty;
D_i=air distance or, alternatively, maritime distance between Peking and the capital of importing area i;
t_{ip}=ad valorem equivalent tariff rate (expressed as a fraction) imposed by importing area i on PRC product p;
QR_{ip}=a dummy variable expressing the existence or absence of any type of quantitative restriction specifically directed against PRC product p by importing area i.[12]

These equations are assumed to provide values of the relative shares (CS). Thus, several of the manipulations do not preserve the sum of shares at unity (the log forms do not, as well as the subsequent insertion of MFN or GSP tariff values into the U.S. equation). Where the sum is not preserved, all values of CS were scaled proportionately to restore the sum to unity.

The world shares (WS) are taken to represent relative strengths of demand in the different importing areas. Distance is a proxy for freight charges, but it is also a proxy, albeit imperfect, for political and cultural relations, an index of length of acquaintance and degree of historical relatedness, as well as of ease of commercial contacts. Both air and maritime distances were therefore used, as alternatives. Maritime distance more frequently appeared in the equation of best fit (17 times for maritime distance, 6 times for air distance).

B. The Estimating Procedure

The set of products specifically examined was the top 50 PRC exports (by dollar value, at the 4- to 5-digit SITC level) to The Twenty in 1976.[13] These top 50 items accounted for 64 percent of 1976 PRC exports to The Twenty. From this sample of 50, we eliminated from consideration of MFN impact those items for which the difference between the discriminatory rate and the MFN rate did not exceed 5 percent.[14] For each of the 27 remaining products, actual data for The Twenty for the year 1976 were entered into the estimating equations, Eqs. (2.1)–(2.4), plus variants of these four equations that omitted one or more of the independent variables. Ordinary least squares estimates were obtained.[15] The criteria for acceptance of the results were conformity of coefficients to the expected signs and t-tests at the 0.1 or better level of significance. Beyond that, if several variants met both tests, selection was made on the basis of the number of variables included in the model and the value of $\bar{R}^2$. In a few instances, marginally acceptable equations were admitted.[16]

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[12] The use of a 2-valued dummy variable leaves a great deal to be desired. It does not distinguish between the various types of QRs nor does it indicate how stringently a QR is applied. The QR term in our regression equations turned out to be significant only for the cotton fabric categories (see Appendix B).

[13] See Appendix A for the itemized list of products, their 1976 export values to The Twenty and to the United States, and the U.S. MFN and non-MFN tariff rates.

[14] The ad valorem equivalent tariff rates used in this study are provided in Appendix A.

Once the most acceptable estimating equation and its coefficients were derived for each product, the U.S. MFN tariff rate, along with the other relevant U.S. data, was inserted into the equation. Using the new calculated value of U.S. share, the total of all shares was rescaled to sum to 100 percent. Thus scaled, the new predicted U.S. share minus the old was the predicted change in share. This change in U.S. share was multiplied by actual 1976 imports of that product by The Twenty from the PRC, to arrive at our estimate of the increase in U.S. imports of that product from the PRC in 1976, had MFN been in effect.

In order to estimate the impact of MFN on total U.S. imports from the PRC, the sum of the top 50 sample product results had to be extended to the entire set of imports. Clearly, there were items below the top 50 which were tariff sensitive despite their omission from the sample tested. To compensate, we scaled up the sample results, multiplying by the following ratio:

$$\frac{\text{value of total U.S. imports from PRC}}{\text{value of U.S. imports from the PRC of top 50 imported by The Twenty}}$$

Finally, we repeated the entire process to estimate the GSP impact. Table 1 of the next section provides all of the results, item by item.

3. THE MFN IMPACT

Table 1 shows the estimated increments in U.S. imports from the PRC in 1976 that would have resulted from the application of MFN or GSP tariff rates.

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[15] Marc Rubin has suggested to us that the logit model of weighted ordinary least squares would have been preferable for shares estimation but we decided that our model in its present form did not deserve the refinement.

[16] All of the equations derived from this study are displayed in Appendix B, with their statistical characteristics.

TABLE 1.—UNITED STATES IMPORTS FROM THE PEOPLE'S REPUBLIC OF CHINA IN 1976: ACTUAL IMPORTS AND ESTIMATED MFN AND GSP-INDUCED INCREASES

[In thousands of dollars]

SITC[1]—Description	Actual imports	Estimated increase	
		MFN	MFN and GSP
0250 (GSP)—Eggs	333	18	53
0539 (GSP)—Preserved fruit and nuts	56	244	819
0542 (GSP)—Legumes	58	19	37
0551—Dried vegetables	574	1, 523	1, 523
1210—Tobacco, unmanufactured	191	18	18
5417 (GSP)—Medicaments	85	3, 310	4, 028
6130 (GSP)—Furskins, dressed[2]	25	151	231
65213—Unbleached woven cotton fabrics	32, 544	971	971
65229—Bleached dyed woven cotton fabrics	579	831	831
65311—Silk fabrics	616	5, 441	5, 441
65691—Linens, textile furnishings	3, 450	13, 542	13, 542
6664—Porcelain, chinaware	1, 543	2, 471	2, 471
84113—Men's boys' undergarments (excludes knit)	3, 680	934	934
8413 (GSP)—Leather apparel	148	760	1, 075
84143—Knit undergarments	1, 164	1, 783	1, 783
85102—Footwear	3, 244	106	106
89922 (GSP)—Basketwork	10, 096	7, 041	11, 174
Subtotal for U.S. imports of tariff-sensitive items among 1976 top 50 PRC exports to The Twenty	58, 386	39, 163	45, 037
Subtotal for all 1976 top 50	132, 419	39, 163	45, 037
Total U.S. imports from the PRC	201, 920	59, 718	68, 675
Estimated percent increase with lowered tariff rates		30	34

[1] Standard International Trade Classification (Rev. 1) of the United Nations. Those items eligible for Generalized System of Preferences tariff treatment are marked (GSP).

[2] Since the United States was the only nation with quantitative restrictions against furskin imports from the PRC, the estimating equations were not sensitive to the QR variable. Nevertheless, we believe that were the ban lifted the increase in imports of furskins would be much larger than the figures shown here.

The results show few surprises. 42 of China's 50 principal hard-currency exports fall into just 2 major categories: food and other plant and animal products (26 items), and textiles and clothing (16 items). The latter group has much larger non-MFN to MFN tariff differentials, on the whole. In fact, only 8 of the 26 items in the first category have tariff differentials greater than 5 percentage points, and only 5 of these proved to be tariff sensitive. In the textile and clothing category, however, 15 of the 16 have tariff differentials greater than 5 percentage points, and of these, 9 were tariff sensitive. Of the seven clothing items in the textile and clothing category, all three outer-garment items were non-tariff-sensitive items, and this did seem surprising. All three provided significant regression results, but the tariff rate was not a significant variable, and in every case the distance variable was important.

The remaining 8 items of the top 50 consisted of: crude petroleum and distillate fuels (both with tariffs effectively zero under both MFN and non-MFN treatment),[17] tin (again, zero tariffs), tungsten ore (7-point tariff differential), fireworks (differential close to zero), medicaments (20-point tariff differential), porcelain and chinaware (46-point tariff differential), and basketwork (32-point tariff differential).

Of the 28 items with tariff differentials greater than 5 percentage points, 27 yielded acceptable regression equations,[18] and 17 of these included the tariff rate as a significant variable. These equations together indicate that 1976 U.S. imports of the 17 items would have amounted to $39 million more than their actual U.S. imports that year. The largest rise, $13.5 million, would have occurred in the category of "linens and other textile furnishings" (the tariff rate for this category would drop by 43 percentage points if MFN were granted). The second largest predicted rise occurs in the basketwork category, with an additional $7 million of imports on top of the actual value of $10 million (the tariff differential here is 32 percentage points). Silk fabrics come in third in absolute rise. Here the value would have been 10 times higher, growing from $616,000 to a $6 million total. The 50-point tariff differential on silk fabrics is higher than the differential for any other item on the list.

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[17] Official tariff rates for petroleum and petroleum products range narrowly around 1 percent for column 1 and 4 percent for column 2. However, a system of license fee rebates against tariff paid usually reduces the effective tariff to close to zero.

[18] The one product which did not provide us with an acceptable equation was tungsten ore. However, the dependence of tungsten ore import shares from the PRC upon import shares from the world showed strong statistical significance. We had simply not included any bivariate regressions among our variant equation forms.

Linens, basketwork, and silk fabrics together would have accounted for exactly two-thirds of the rise in U.S. imports of the top 50 items, and 43 percent of the total estimated rise in U.S. imports from the PRC. By contrast, the four clothing items in table 1, combined, would have accounted for only a $3.6 million increase. We have already pointed out that outergarments are not among those for which an increase is predicted. The leading item in actual U.S. imports, cotton fabrics, would have experienced no more than a modest rise (the tariff differential is only 7 percentage points).

4. Discussion

At $201.9 million in 1976 ($202.7 million in 1977), U.S. imports from the PRC represent little more than one-tenth of 1 percent of total U.S. imports. The 30-percent estimated increase in value of imports from the PRC that might result if MFN were granted would thus have little impact on the U.S. import total. Even on a product-by-product basis, the estimated effects are not large. The largest estimated increase, $13.5 million worth of linens in 1976, would have raised imports from China to an amount equal to 15 percent of total 1976 U.S. imports of linens from the world.

Furthermore, while some increase in total U.S. imports of linens would probably have resulted from increased imports from China, a substantial portion of the increment in imports would likely displace imports of the same type of products from elsewhere in the world, rather than displacing domestic suppliers. Displacement of other imports, rather than of U.S. products, seems especially likely for items like basketwork, silk fabrics, and medicaments (largely natural plant products), for which the second, third, and fourth largest increments, respectively, were predicted by our model.

The major goal of this study was to estimate the percentage rise in U.S. imports from the PRC consequent upon the granting of MFN. Although the calculations were based upon 1976 data, we believe that changes in implicit background factors that will make the results less and less applicable to future years are occurring only slowly. These are such factors as political relationships between The Twenty and the PRC, formal and informal commercial facilitation arrangements, and the relative importance of PRC commercial relationships with countries other than The Twenty. The explicit factors that we have held constant to obtain our estimates of the tariff effect—world share, distance, and QR's—are also slow to change, or unchanging.

But even if the parametric values we have derived for each of our equations were to remain valid as time goes on, our estimate of the MFN-induced percentage rise to be expected in total U.S. imports from the RPC will change as the product mix of PRC exports changes. It is even possible that the granting of MFN would induce PRC planners to expand preferentially those export industries which would profit most from the U.S. tariff lowering. Such an alteration of export product mix could eventually increase the MFN impact on U.S. imports above the 30-percent estimate.

In the short run, the products listed in table 1 are the prime candidates for MFN-induced export expansion. But of these, all of the textile products (including clothing other than leather apparel) are subject to stringent nontariff restraint mechanisms that could quickly be invoked to moderate or negate the favorable tariff effect.[19] Footwear has also experienced market disruption problems in the United States, with resulting specific quota restrictions. The remaining items of table 1, then, are the ones that would be most likely to benefit, in the short run, from increased opportunities for sale in the United States. These are dried vegetables and tobacco, porcelain and chinaware, and the GSP items (whether or not China receives GSP treatment) [20]—all traditional Chinese products. In the longer run, of course, as China modernizes, products of higher technology that do not appear on the top 50 list for 1976 may well turn out to be the greatest eventual beneficiaries of MFN.

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[19] It is our judgment that quantitative restrictions of various kinds—international agreements, bilatera consultation, global or country-specific quotas, market disruption or antidumping actions, countervailing duties, and a host of others—are far more effective than tariff adjustments in regulating the flow of imports. Only two of our estimating equations included a statistically significant QR term, but this variable was admittedly poorly delineated, due to lack of information plus the inherent difficulty of quantifying such a set of diverse instruments.

[20] It is highly unlikely that GSP items would cause market disruption problems. The U.S. Government composes its own list of GSP products, and alters it at will (see footnote 5, above).

APPENDIX A

1976 TOP 50 PRC EXPORTS TO THE 20, WITH AD VALOREM EQUIVALENT U.S. TARIFF RATES[1]

SITC[2]		1976 imports (thousands of dollars)		U.S. tariff[3] (percent)	
		The Twenty	United States	Col. 1	Col. 2
33101	Crude petroleum	568,063	0	0	[4] 0
0013	Swine	174,089	0	1.7	6.7
65213	Unbleached cotton fabrics	161,811	32,544	8.7	15.2
65691	Linens	138,181	3,450	15.7	59.3
0422	Rice, polished	135,882	7	2.7	4.0
2613	Raw silk	128,168	3,948	0	.2
0313	Crustacea	95,339	4,231	.1	.2
65229	Bleached, dyed cotton fabrics	92,304	579	8.3	14.7
2924	Plants, seeds, etc	84,353	1,405	.2	1.6
[5] 89922	Basketwork	79,677	10,096	13.2	45.3
65311	Silk fabrics	63,272	616	11.4	61.6
[5] 0250	Eggs	60,374	333	8.1	23.1
0311	Fish, fresh, frozen	58,829	1,012	.7	1.5
05552	Preserved vegetables	53,710	568	11.4	16.1
[5] [6] 6130	Dressed furskins	50,955	25	4.8	27.7
84111	Men's, boys' outergarments	49,661	1,999	23.9	57.2
2623	Fine animal hair (excludes wool)	49,407	3,178	2.3	9.1
05172	Nuts (excludes peanuts)	49,208	326	2.4	4.0
2214	Soya beans	48,612	0	3.8	7.6
29193	Inedible animal offals	47,276	133	0	0
2631	Raw cotton	45,847	0	2.0	4.1
[5] 59964	Rosin, etc	45,655	605	5.0	5.0
29192	Bristles	42,282	8,064	.4	1.2
0113	Swine meat	42,223	0	.8	4.0
[5] 29196	Feathers	40,697	14,240	0	[4] 0
6664	Porcelain	39,223	1,543	26.7	73.0
[5] 0542	Legumes	37,504	58	4.0	9.9
0551	Dried vegetables	37,146	574	13.6	38.5
6871	Tin	36,662	13,195	0	0
0741	Tea	36,457	2,874	0	0
6575	Carpets	35,778	4,252	11.0	45.3
3323	Distillate fuels	34,043	0	0	[4] 0
84113	Men's, boys' undergarments (excludes knit)	33,362	3,680	20.7	46.5
6513	Cotton yarn	33,059	0	7.6	13.6
84143	Knit undergarments	33,020	1,164	28.3	67.8
0545	Fresh vegetables (excludes legumes, tomatoes, potatoes.	32,549	214	23.0	31.7
[5] 01189	Edible offals, n.e.s	31,899	459	3.1	10.7
0014	Live poultry	30,745	0	3.0	8.0
28392	Tungsten ore	30,013	2,289	7.1	14.6
[5] 5713	Fireworks	29,604	6,565	12.4	12.9
1210	Tobacco, unmanufactured	27,560	191	21.5	58.8
84112	Ladies', etc., outergarments	27,321	3,395	23.1	70.9
[5] 0539	Other fruit and nuts	27,143	56	5.8	13.5
84144	Knit outergarments	27,139	1,599	35.6	71.9
2211	Green peanuts	27,084	43	9.8	9.8
85102	Footwear	26,594	3,244	11.0	22.6
[5] 0116	Edible offals (bovine, etc.)	26,253	0	2.6	30.8
0138	Preserved meat	25,711	0	4.4	8.8
[5] 5417	Medicaments	25,462	84	5.0	25.0
[5] 8413	Apparel, of leather	24,526	148	9.6	33.2

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[1] Col. 1 rates were obtained from the GATT Tariff Study tapes. U.S. 1974 imports from the world were used as weights. Col. 2 rates were calculated by the authors, using the same weights.

[2] Standard International Trade Classification (Rev. 1) of the United Nations.

[3] Col. 1 (of the Tariff Schedules of the United States) is the MFN rate. Col. 2 is the non-MFN rate for specified Communist countries.

[4] Tariff either temporarily suspended or offset by rebates in 1976.

[5] Articles eligible for duty-free treatment under the Generalized System of Preferences.

[6] U.S. imports of ermine, fox, kolinsky, marten, mink, muskrat, and weasel furskins from the PRC are forbidden by sec. 11 of the Trade Agreements Extension Act of 1951. Weasel and kolinsky are most strongly affected.

APPENDIX B. ESTIMATING EQUATIONS

CS=share of imports from PRC (expressed as a fraction)
D_a=air distance (in miles $\times 10^{-4}$)
D_m=maritime distance (in miles $\times 10^{-4}$)
WS=share of imports from world (expressed as a fraction)
QR=quantitative restrictions (0 or 1 for linear equations, 1 or 2 for log linear)
t=tariff rate (expressed as a fraction)

NOTE—Figures in parentheses are student "t" values.

SITC:

0116

$$CS-WS=0.346-\underset{(-2.701)}{0.809D_a}$$

$\bar{R}^2=0.26 \qquad d.f.=17$

01189

$$LnCS=-4.386+\underset{(3.275)}{0.999LnWS}-\underset{(-1.320)}{2.023LnD_a}$$

$\bar{R}^2=.33 \qquad d.f.=16$

0250

$$LnCS=-7.332-\underset{(-2.013)}{11.706Ln(1+t)}-\underset{(-3.564)}{2.428LnD_m}$$

$\bar{R}^2=0.48 \qquad d.f.=16$

0539

$$CS=0.258+\underset{(5.158)}{0.809WS}-\underset{(-1.684)}{0.116(1+t)}-\underset{(-4.634)}{0.140D_m}$$

$\bar{R}^2=0.66 \qquad d.f.=15$

0542

$$LnCS-LnWS=-2.882-\underset{(-1.660)}{6.116Ln(1+t)}-\underset{(-3.692)}{1.672LnD_m}$$

$\bar{R}^2=0.41 \qquad d.f.=16$

0545

$$LnCS-LnWS=-7.423-\underset{(-7.424)}{4.123LnD_m}$$

$\bar{R}^2=0.75 \qquad d.f.=17$

0551

$$CS=0.305+\underset{(4.244)}{1.048WS}-\underset{(-2.473)}{0.174(1+t)}-\underset{(-4.570)}{0.138D_m}$$

$\bar{R}^2=0.80 \qquad d.f.=15$

1210

$$LnCS-LnWS=-3.784-\underset{(-1.430)}{3.063Ln(1+t)}-\underset{(-3.234)}{3.203LnD_m}$$

$\bar{R}^2=0.32 \qquad d.f.=16$

2623

$$LnCS=-2.078+\underset{(8.548)}{1.019LnWS}-\underset{(-1.759)}{1.436LnD_a}$$

$\bar{R}^2=0.80 \qquad d.f.=16$

5417

$$CS-WS=0.897-\underset{(-1.415)}{0.667(1+t)}-\underset{(-2.920)}{0.232D_m}$$

$\bar{R}^2=0.35 \qquad d.f.=16$

6130

$$LnCS=-2.283+\underset{(4.470)}{0.950LnWS}-\underset{(-1.251)}{7.403Ln(1+t)}-\underset{(-2.196)}{1.513LnD_m}$$

$\bar{R}^2=0.55 \qquad d.f.=15$

6513

$$CS=0.232+\underset{(3.177)}{1.048}WS-\underset{(-4.024)}{0.548}D_a$$

$\bar{R}^2=0.66$ $d.f.=16$

65213

$$CS=0.268+\underset{(5.605)}{1.063}WS-\underset{(-3.989)}{0.279}D_a-\underset{(-1.613)}{0.116}(1+t)-\underset{(-2.753)}{0.073}QR$$

$\bar{R}^2=0.72$ $d.f.=14$

65229

$$CS-WS=0.340-\underset{(-1.779)}{0.165}(1+t)-\underset{(-3.669)}{0.157}D_m-\underset{(-2.458)}{0.103}QR$$

$\bar{R}^2=0.60$ $d.f.=15$

65311

$$CS=0.255+\underset{(3.802)}{0.945}WS-\underset{(-1.879)}{0.213}D_a-\underset{(-1.601)}{0.135}(1+t)$$

$\bar{R}^2=0.42$ $d.f.=15$

65691

$$CS-WS=0.429-\underset{(-2.140)}{0.224}(1+t)-\underset{(-4.092)}{0.194}D_m$$

$\bar{R}^2=0.52$ $d.f.=16$

6575

$$LnCS=-0.911+\underset{(6.941)}{1.270}LnWS-\underset{(-2.057)}{1.542}LnD_a$$

$\bar{R}^2=0.72$ $d.f.=16$

6664

$$CS-WS=0.380-\underset{(-2.050)}{0.188}(1+t)-\underset{(-3.483)}{0.186}D_m$$

$\bar{R}^2=0.45$ $d.f.=16$

84111

$$LnCS-LnWS=-1.613-\underset{(-4.444)}{1.573}LnD_m$$

$\bar{R}^2=0.51$ $d.f.=17$

84112

$$LnCS-LnWS=-1.939-\underset{(-4.284)}{2.246}LnD_m$$

$\bar{R}^2=0.49$ $d.f.=17$

84113

$$CS-WS=0.306-\underset{(-1.749)}{0.149}(1+t)-\underset{(-3.427)}{0.157}D_m$$

$\bar{R}^2=0.38$ $d.f.=16$

8413

$$CS=0.224+\underset{(1.572)}{0.383}WS-\underset{(-1.334)}{0.161}(1+t)$$

$\bar{R}^2=0.11$ $d.f.=16$

84143

$$CS=0.367-\underset{(-2.082)}{0.143}(1+t)-\underset{(-3.883)}{0.165}D_m$$

$\bar{R}^2=0.51$ $d.f.=16$

84144

$$LnCS-LnWS=-2.580-\underset{(-3.793)}{2.644}LnD_m$$

$\bar{R}^2=0.43$ $d.f.=17$

85102

$$LnCS=-4.065-\underset{(-1.783)}{2.308}Ln(1+t)-\underset{(-3.474)}{1.005}LnD_m$$

$\bar{R}^2=0.47$ $d.f.=16$

89922

$$LnCS=0.124+\underset{(18.851)}{0.951}LnWS-\underset{(-1.806)}{1.961}Ln(1+t)$$

$\bar{R}^2=0.96$ $d.f.=16$

CHINESE RELATIONS WITH THE THIRD WORLD

By Carol Fogarty

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I. Key Points

First. Political turbulence in the People's Republic of China and the slowdown in domestic economic growth led to a decline in economic aid pledges to the Third World in 1975–77, to less than $200 million a year from the $500 million annual commitments of the first 5 years of the decade.

Second. Aid disbursements, on the other hand, maintained a brisk pace at $220 million a year in 1975–77, as earlier commitments were carried out and as new countries were added to the list of recipients.

Third. The number of Chinese technicians in the Third Woild rose to an all-time high of 24,000 in 1977.

Fourth. China gets good marks for its economic aid program, which emphasizes small-scale development programs and tailors projects to the needs and resources of its Third World clients.

Fifth. Chinese-LDC trade has become an important source of hard currency for China, at the same time providing new markets for Third World raw materials.

Sixth. Military transfers, which are concentrated overwhelmingly in Pakistan, have been a small fraction of the Chinese aid program and are dwindling in the face of Soviet and Western competition.

II. Fluctuations in Economic Aid

The recent lull in the economic aid commitments of the People's Republic of China has as its backdrop a 20-year history of sharply fluctuating annual aid levels. These fluctuations have reflected economic and political developments at home and changing attitudes toward the cost and benefits of aid.

In the late 1950's China concentrated about $150 million of aid on neighboring countries in its drive to gain influence in East Asia.

In the early 1960's Chinese economic aid became identified as an African program, as the People's Republic moved to fill the gap left by departing colonial powers and to preempt a corresponding growth in Soviet influence. By 1964, when annual extensions of aid had soared to $300 million—mostly to Africa—Peking was supporting dissident groups in countries that had accepted a Chinese aid presence. In 1965, new pledges fell to $70 million as Peking's subversive activity made many less developed countries (LDC's) wary of Chinese aid offers. The onset of the Chinese Cultural Revolution—1966–69—isolated China from the mainstream of international economic and political life and was reflected in the virtual cessation of new Third World project commitments.

In 1970, China reappeared on the international scene determined to assert itself as a major power. Economic aid programs, orginally tailored to serve PRC objectives in the Sino-Soviet conflict of the 1960's, were stripped of their ideological content and were deployed as a major foreign policy weapon in China's campaign to attain leadership among developing countries. In 1970, China pledged more than $700 million of new economic aid to the LDC's, Peking's largest annual commitment—more than 10 times Peking's average aid undertakings in any previous year and equal to two-thirds of all Chinese economic aid extended to the Third World in the previous 14 years of the aid program. (See table 1). In the 5-year period 1970–74, China boosted its commitment to LDC's by $2.7 billion, more than double the $1.1 billion provided in 1956–69. Almost two-thirds of the new assistance went to Africa.

In 1974, the economic aid program again fell victim to domestic political infighting. Annual pledges plunged to one-half of the euphoric half-billion dollar average of earlier years. The internal power struggle pitted Madame Mao, leader of the radical "Gang of Four," against comparatively moderate forces that opposed the politicization of Chinese economic policy. The arrest of the radical leaders following Chairman Mao's death in September 1976 was a major step toward the stability needed to reassess and regularize PRC economic policy. In the fall of 1977, the new Hua regime broke China's long public silence on the subject of economic aid to the Third World by pledging to honor Chairman Mao's policy of helping poorer nations.

The new leadership has hastened to point out that future aid programs will be limited by China's own status as a poor and developing country. The power struggle of the midseventies disrupted economic planning and cut into industrial growth, while severe earthquakes in the summer of 1976 disrupted industry and transportation. Furthermore, poor weather in 1976 and 1977 prevented any increase in grain production, this despite sizable increases in inputs of fertilizer and machinery. Chinese plans to increase domestic agricultural and industrial productivity, which hinge on imports of technology from the West, compete for some of the same resources needed in foreign aid projects.

As they move to harness foreign aid policy to domestic economic realities and international political objectives, Chinese planners are redirecting limited aid assets toward specific immediate goals. With its international reputation for effective aid already secured by its highly publicized aid efforts of the early 1970's, the People's Republic can now afford to use aid more selectively to pursue more parochial aims in the Third World. Chinese officials have hinted that any resources left over from domestic development will go to countries willing to publicly endorse Chinese policies, particularly those contrary to Soviet interests. For example, China was quick to promise further development support to Egypt in 1976 and Somalia and Sudan in 1977 when they renounced their ties with Moscow, although no formal agreements were signed.

TABLE 1.—CHINA: ECONOMIC AID EXTENDED TO THE THIRD WORLD, 1956–77

[In million U.S. dollars]

	Total, 1956–77	Total, 1956–69	1970	1971	1972	1973	1974	1975	1976	1977
Total	4, 319	1, 103	747	514	604	565	275	299	95	117
Africa	2, 340	374	454	333	244	356	235	208	69	67
North Africa	306	57		60	41	2	57	32		57
Algeria	92	52		40						
Mauritania	85	5		20	1	2	57			
Morocco	32							32		
Tunisia	97				40					57
Sub-Saharan Africa	2, 034	317	454	273	203	354	178	176	69	10
Benin	44				44					
Botswana	3								3	
Burundi	20				20					
Cameroon	71					71				
Cape Verde	(1)									(1)
Central African Empire	14	4							[2] 10	
Chad	50					50				
Comoros	(3)								(3)	
Congo	50	25			25					(3)
Equatorial Guinea	(3)			(3)						
Ethiopia	85			84		1				
Gabon	25							25		
Gambia	17							17		
Ghana	42	42								
Guinea	77	67	[2] 10							
Guinea-Bissau	17							17		
Kenya	17	17								
Liberia	10									[2] 10
Madagascar	68				11			57		
Mali	73	53				20				
Mauritius	35				35					
Mozambique	59							59		
Niger	51						51			(1)
Rwanda	22				22					
Sao Tome and Principe	(3)							(3)		
Senegal	52					52				
Sierra Leone	41			40	1					
Somalia	132	22		109				1		
Sudan	82		42	40						
Tanzania	360	56	201				75		28	
Togo	45				45					
Uganda	15	15								
Upper Volta	50					50				
Zaire	100					100				
Zambia	307	16	201			10	52		28	
East Asia	307	224		57			25	1	(3)	
Burma	84	27		57						
Cambodia	92	92								
Indonesia	105	105								
Laos	26						25	1		
Western Samoa	(3)								(3)	
Europe	45				45					
Malta	45				45					
Latin America	153			44	89		9	10	1	
Chile	65			2	63					
Guyana	36				26			10		
Jamaica	10						9		1	
Peru	42			42						

Footnotes at end of table p. 384.

TABLE 1.—CHINA: ECONOMIC AID EXTENDED TO THE THIRD WORLD, 1956–77—Continued

[In million U.S. dollars]

	Total, 1956–77	Total, 1956–69	1970	1971	1972	1973	1974	1975	1976	1977
Middle East	426	194	43	45	88	29	2		25	(3)
Egypt	134	106				28				
Iraq	45			45						
Jordan	(3)									(3)
Kuwait	(3)									(3)
North Yemen	107	60			21	1			25	
South Yemen	79	12	43		22		2			
Syria	61	16			45					
South Asia	1,048	311	250	35	138	180	4	80		50
Afghanistan	76	28			48					
Bangladesh	61	11								50
Nepal	180	62		3	35			80		
Pakistan	573	157	250			166				
Sri Lanka	158	53		32	55	14	4			

[1] Less than $500,000.
[2] Estimate.
[3] Agreement signed, but value of credits, if any, is not known.

TABLE 2.—*China: Economic aid deliveries to the Third World*

	Millions (*U.S.*)
1956–67	$445
1968	70
1969	70
1970	70
1971	190
1972	260
1973	240
1974	250
1975	180
1976	285
1977	200
Total	2,260

TABLE 3.—*China: Economic Technicians in the Third World* [1], *1977*

	Persons
Algeria	250
Mauritania	300
Morocco	20
Tunisia	50
North Africa	620
Angola	10
Cameroon	100
Central African Empire	25
Congo	200
Ethiopia	250
Gabon	65
Gambia	50
Ghana	50
Guinea	300
Guinea Bissau	50
Liberia	225
Madagascar	150
Mali	500
Mozambique	100
Niger	175
Nigeria	100
Rwanda	1,500

Footnotes at end of table p. 855.

Table 3.—*China: Economic Technicians in the Third World*[1], *1977*—Continued

	Persons
Senegal	100
Somalia	3, 000
Sudan	2, 000
Tanzania	1, 000
Togo	15
Uganda	25
Upper Volta	50
Zaire	425
Zambia	5, 000
Other	5, 235
Sub-Saharan Africa	20, 700
Africa	21, 320
East Asia: Burma	130
Europe: Malta	300
Guyana	75
Jamaica	5
Peru	15
Other	40
Latin America	135
Egypt	25
Iraq	200
North Yemen	450
South Yemen	425
Syria	50
Other	25
Middle East	1, 175
Afghanistan	135
Bangladesh	20
Nepal	250
Pakistan [2]	250
Sri Lanka	300
South Asia	955
Total	24, 015

[1] Minimum estimates of the number present for 1 month or more, rounded to the nearest five. Includes laborers in some countries.

[2] Excludes up to 20,000 Chinese personnel working on a border road project.

III. Evaluation of Economic Aid, 1975–77

There were no surprises in China's aid offerings in 1975–77; most of them focused on Africa and only four agreements exceeded $50 million in value. The moderate size of China's recent agreements is more in keeping with China's economic capability than the commitments earlier in the decade.

As for those earlier programs, Peking's $400 million commitment to the Tan-Zam railroad, accounting for over half of the record extensions of 1970, remains the exception to the usual Chinese practice of providing lines of credit spread over a number of development sectors within the recipient country. The typical Chinese aid package of the early seventies was in the $40 to $100 million range, allocated to a variety of projects. Since 1974, individual new offerings have shrunk in size, and some agreements call only in general terms for economic cooperation without specifying the value of credits. Recent agreements continue to stress labor-intensive light industrial and agricultural projects, with a high technical assistance component. Peking has turned down several African requests to provide assistance to railway construction and other major infrastructure projects.

China's economic aid program maintained a brisk pace in 1975–77 when measured by actual disbursements. Thirty percent of the $2.3 billion in total aid deliveries to LDC's came in these 3 years. (See table 2, p. 854.). Whereas deliveries in 1971–74 were dominated by the needs of the Tan-Zam railroad project, deliveries in 1975–77 were more widely distributed. Major project starts included a $55 million deep water port project in Mauritania, studies for a $90 million canal project in Tunisia, a road in Madagascar, expansion of a heavy machinery complex in Pakistan, and a $30 million irrigation project in Sri Lanka. Road construction projects costing $400 million neared completion in Ethiopia, Pakistan, Rwanda, Somalia, Sudan, and the Yemens.

Chinese agreements to finance local project costs in the Third World have enabled China to cope with shortages of local funds and skills that often jeopardize the success of undertakings by other aid donors. Chinese commodities and consumer goods for sale on LDC markets usually take up about one-third of Chinese credits. The proceeds are used for the purchase of land, local building materials and equipment, and salaries of local workers. While some LDC's have complained about the difficulty in disposing of some Chinese goods because of poor workmanship and high prices, most agree that local funding contributes heavily to the success of Chinese programs. The Chinese maintain tight control over aid projects, providing administrators, skilled personnel, and often unskilled laborers as well.

More than 24,000 Chinese technicians were employed in Third World countries in 1977, the highest number since the beginning of the program. The departure of 10,000 technicians from the Tan-Zam railroad construction site was offset by an influx to other African projects. Sub-Saharan Africa continues to account for about 85 percent of the Chinese aid personnel abroad.

In 1977, about 40 percent of Chinese personnel stationed abroad were working on transportation projects, 30 percent on agricultural projects, and 5 percent on medical projects. China's low-cost technical services program has been the most widely praised aspect of the PRC development effort. China does not charge hard currency for technicians; LDC's pay only a local subsistence allowance (the equivalent of about $1,200 a year), for housing, food, and transportation costs within the country. In some cases, particularly for medical teams, China probably defrays even these modest local costs. (See table 3, pp. 854–855.)

Medical services have proven one of China's most effective economic aid programs in the Third World. The $50 million of known Chinese assistance to public health has gone largely to construct hospitals in 16 countries; this sum does not include the wider effort that has brought Chinese medical teams to at least 35 developing countries. About 1,500 Chinese medical personnel were working in developing countries in 1977. Most of them operate rural clinics that in many cases have brought the first medical services to patients in outlying areas. Chinese medical assistance has attempted to address a priority need of poorer LDCs' for a basic health services program, not limited to urban centers. Chinese medical teams typically are composed of 10 to 15 physicians, laboratory technologists, and assistants who bring their own equipment and medicines with them.

IV. General Assessment of Economic Aid Program

China's reputation as aid donor among poorer nations is unmatched. The provision of well-balanced aid packages that effectively promote both economic and social development has enabled China to escape criticism often levied against Western programs for ignoring basic human needs. Chinese aid packages have allowed for improvement of welfare and productivity while attacking basic deficiencies in infrastructure and agriculture.

For example, Mauritania's President, in a recent newspaper interview,[1] identified Chinese aid as most important because "China's involvement in health, agriculture and construction leads to the establishment of an economic infrastructure." Chinese skills and technology have been particularly pertinent to the poorest LDC's; countries with annual per capita incomes of less than $200 have received more than half of China's aid pledges since the beginning of the program.

Chinese economic aid always has been directed toward the development of infrastructure, primary industries, and agriculture. The most prominent contributions are still to railway, road, bridge and port construction (35 percent). Aid to agriculture, irrigation and multipurpose projects accounts for 20 percent, and aid to light industry for another 20 percent. Only 5 percent has gone to heavy industry, all in Pakistan. The balance has been channeled to urban development, to geological surveys, and to tourist, sports, educational, cultural, and medical facilities.

Chinese roads and other transport projects open new areas to development and ease bottlenecks in the transport of goods and personnel. In North Yemen, for example, China has built half of the nation's road network, and in Somalia and Sudan, about 10 percent. The Tan-Zam railroad, now operating at partial capacity, has speeded up delivery of goods to the interior and to Zambia, easing congestion at the port of Dar es Salaam.

Industrial and agricultural projects are adapted to the needs of the particular LDC. Profiting from its own post-WWII experiences, China has emphasized low-cost, easily operated projects that will save on imports. Projects often provide simple processing facilities for raw materials. Such light industrial projects as textile, plywood, paper, food processing, and, agricultural implements plants are constructed at low cost and are put into production rapidly. They draw on readily available local resources of manpower and materials. Usually minimal skills are required for their operation and maintenance.

Commodities and cash transfers—sometimes as outright grants—are an important component of the program. China has provided almost half a billion dollars in hard currency and commodities as direct balance of payments support, in addition to the goods that move under credit arrangements to generate funds for development projects.

Chinese aid to the Third World ranks among the most concessional offered by any donor. China has provided nearly half a billion dollars in outright grants during the 1970's, for an overall total exceeding $800 million since the start of the program. In recent years, Peking has further softened the terms of its credits to the Third World. The typical Chinese development agreement of the 1960's was interest-free and allowed repayment over 10 years after 10 years grace. Now, grace periods range up to 20 or 30 years, and amortization periods often are longer than before. These compare with average Western repayment periods of 33 years, including 9 years grace at 2.6 percent interest.

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[1] CHAAB (Mauritania), February 8, 1978.

V. Trade Relationships With Third World

China's expanding aid activities in developing countries have created conditions for initiating and consolidating trade ties. Along with its vigorous aid program, in 1970 China launched a major export drive in LDC markets to assure a long-term return flow of industrial raw materials. In 1976, Chinese trade with the Third World (excluding Hong Kong) totaled $2.5 billion—$400 million below the record established during the price boom in 1974, but still triple the 1970 level. Trade levels turned upward again in 1977.

While China conducts only about one-fifth of its trade with the Third World, these countries have become an important source of foreign exchange earnings. LDC's are helping to pay for Peking's imports of machinery, technology, and industrial materials from the developed world. From an average of $235 million annually in the early part of the decade, the Chinese trade surplus with LDC's rose to $925 million in 1976, compared with an overall deficit of $1.4 billion with the non-Communist industrial countries.

In recent years, LDC's have enhanced their positions as both buyers and sellers on the Chinese market. Third World consumers have become increasingly receptive to Chinese manufacturers, taking about one-third of Peking's industrial exports in 1976; for example, one-half of China's exports of machinery and transport equipment, 25 percent yarn and fabric exports, 25 percent of clothing exports, and more than one-third of grain exports. At the same time, Third World raw materials suppliers captured almost half of the Chinese market for crude mateials in 1976. They provided all of China's $45 million in petroleum imports, more than 90 percent of its rubber and cotton, 75 percent of its crude fertilizers, and half of its nonferrous metals.

VI. Military Aid Developments

China's total military aid commitment to LDC's is a little less than $800 million, largely for small arms, ammunition, vehicles, and training. Though spread among roughly 40 countries, more than 75 percent of the assistance has gone to Pakistan and Tanzania.

The small size of the Chinese military aid program stems from inability to compete with Western or other Communist suppliers in arming Third World establishments. China's military production lags Western and Soviet technology by about 20 years. To overcome its current serious military deficiencies, Peking itself is shopping in Western countries for late model military technology and equipment. Peking's plans for self-sufficiency in producing late-model weaponry depend on revitalizing its industrial sector and only after China can modernize its own forces, will it be willing to share more of its military output with Third World clients.

Regional arms balances have been rapidly changing in the Third World, for example, in the Horn of Africa. These changes are the result of a combination of forces, including the development of indigenous military forces, changes in Third World governments, the ebb and flow of insurgency, and the shifting patterns of military aid from the U.S.S.R. and the big Western suppliers. The strength of these forces has exposed China's limited ability to service arms requests. In the countries where China had established an arms supply relationship, the relationship has now begun to crumble under pressures of competing arms sales by major suppliers. Some of the more important developments are as follows:

1. China's military contribution to Pakistan is expected to diminish as equipment from Western countries begins to flow to Pakistan under the quarter billion dollars worth of deals concluded in 1977. Until recently, China was Pakistan's major supplier, accounting for almost one-third of Pakistan's total foreign defense contracts. Chinese equipment accounts for approximately one-half of Pakistan's air and ground inventories, which include Mig jet fighters, IL–28 jet light bombers, light and medium tanks, and an array of ground forces, communications, and support equipment. China's military effort in Pakistan also has involved small munitions plants and military repair and manufacturing facilities at the Taxila complex.
2. Tanzania, Peking's second largest arms client and the only Third World country to develop an extensive dependence on China for equipment and training, is phasing out Chinese equipment; Tanzania has deliberately shifted to Moscow as its major supplier, to get late-model weaponry that China has been unable to supply.
3. The victorious Soviet-supplied forces that formed the new Government in Angola have refused to recognize China because of Peking's support to the opposition before independence.
4. In Mozambique the new Government brushed aside a decade of Chinese military collaboration in providing small arms and military training for guerrilla groups in favor of a Soviet relationship that could bring more modern weapons.

Such setbacks have made Peking more cautious in entering arms agreements, especially where the potential political payoff seems small. Thus in recent years Peking has provided only token military support for Egypt, Sudan, and Somalia, even though the supply of spare parts for Soviet equipment entailed few risks. In all cases, China has stressed its preference for economic aid as an instrument for peace and stability. Peking denigrates big power arms salesmanship as a sorry contrast to its own contribution to peaceful economic development.

TABLE 4.—CHINA: MILITARY AID TRANSACTIONS WITH THE THIRD WORLD

[In millions U.S. dollars]

	Agreements	Deliveries
Total	795	700
1958–67	225	150
1968	25	25
1969	5	25
1970	65	30
1071	80	60
1972	80	75
1973	25	80
1974	85	25
1975	40	85
1976	125	80
1977	40	65

THE IMPACT OF AID ON ALBANIAN INDUSTRIAL DEVELOPMENT—THE SOVIET UNION AND CHINA AS MAJOR TRADING PARTNERS

By Adi Schnytzer*

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In the case of a small developing socialist economy the choice of major trading partners is often closely linked to the search for economic aid. The Albanian case affords an insight into the differences between the Soviet Union and China as aid donors. In this paper it is argued that foreign aid proved indispensable to the Albanian economy in altering the structure of output and fostering the economic growth desired by the ruling Party of Labour of Albania (PLA). On the other hand, an attempt will also be made to reveal the extent to which reliance on foreign aid has acted as a constraint on the PLA's objectives.

The analysis begins with an attempt to establish a theoretical framework on the basis of both the traditional two-gap development model and a countertheory formulated by Griffin.[1] However, an econometric analysis of the Albanian experience reveals that neither of these approaches to foreign aid problems is particularly effective in providing a theoretical explanation of that experience. It is argued that the Albanian system rules implying centralized economic decision-making and the difference between socialist and capitalist economics as donors preclude the use of models designed for the analysis of market-oriented developing economies. Finally an attempt is made to relate the Albanian concept of self-reliance to the foreign aid issue.

Prior to a consideration of the macroeconomics of aid, an outline of the nature of the foreign aid which the Albanian economy has received since 1945 and the historical background to Albanian requests for aid will facilitate the later analysis. The PLA leadership turned its attention towards the need for foreign aid very soon after it came to power. In his report to the Fourth Plenium of the PLA Central Committee on October 17, 1945, Enver Hoxha noted that both Yugoslavia and the Soviet Union had agreed to provide Albania with credit, but warned against the danger of failure to pay back the loans at the agreed time:

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*The author is with St. Anthony's College, Oxford, England.

[1] K. Griffin, "Foreign Capital, Domestic Savings and Economic Development," *Bulletin of Institute of Economics and Statistics,* May, 1970, pp. 99–112.

> If we do not improve the economic sector, our obligations to our people and to the states with which we have entered trade agreements will cause us to become politically dependent. We should not forget this: We have had a bitter past.[2]

Further on the report refers to Albania's oil deposits and planned Soviet assistance in their exploitation:

> Oil is our main resource, and interests everybody. Of course, in this vital sector we will rely on the help of the Soviet Union, but we will consider the interest of our country first.[3]

Thus, Enver Hoxha's preference for political independence in the matter of economic development had been made clear. However, the close relationship which developed between Albania and Yugoslavia and culminated in the signing of an agreement in November 1946 which would effectively incorporate the Albanian economy into the Yugoslav Federation suggests that the PLA leadership was divided on the development issue.[4]

When the split between Belgrade and Moscow became clear in 1948, Hoxha was able to use Stalin's hatred of Tito to obtain assistance in purging the pro-Yugoslav wing of the PLA, which was led by Koci Xoxe. As table 1 shows, Albania received 147.5 million new leks aid between 1945 and 1948, of which some had come from UNRRA [5]—$23.6 million, of which the United States provided $20.4 million—but the larger part had been provided by Yugoslavia. Although the aid is measured as a surplus of Yugoslav deliveries over imports, Hoxha argued in October, 1948, that in fact the aid had come via Yugoslavia from the Soviet Union. He gave his sources as Molotov and Stalin:

> When it came to economic matters, Molotov said, "the Soviet Union will unsparingly help the Albanian people to rebuild their economy, but this help will be given through Yugoslavia, purely for reasons of foreign policy." Comrade Stalin repeated this to us when we went to Moscow.[6]

Notwithstanding the validity of this argument, it is clear that, from Hoxha's viewpoint, close economic ties with Yugoslavia were incompatible with his development strategy for Albania. The Albanian economy thus came to rely mainly on the Soviet Union and other members of Comecon for aid after 1948. The Soviet presence in Albania may conveniently be broken into two phases, the first of these running from 1948 to 1954 when the death of Stalin was followed by the New Course in the Soviet Union and the second phase representing the delivery of economic aid designed better to integrate the Albanian economy into Comecon and coming to an end in 1961.

The report delivered to the PLA Central Committee by Enver Hoxha on December 24, 1953 was discussed in the previous chapter, where it was noted that a downward revision of targets for the 1st 5-year plan had been necessitated by an unrealistic emphasis on industrial production at the expense of agriculture. The report notes that this situation was exacerbated by the use to which Soviet aid had been put:

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[2] E. Hoxha, *Selected Works*, Vol. 1 (Tirana, 1974), p. 452.

[3] *Ibid.*, p. 453.

[4] The so-called Economic Convention was accompanied by protocols on the co-ordination of planning, currency parity, and price unification.

[5] M. C. Kaser, "Trade and Aid in the Albanian Economy", in Joint Economic Committee, U.S. Congress, *East European Economies post-Helsinki*, U.S. Government Printing Office (Washington DC, 1977), pp. 1325–1340.

[6] E. Hoxha, *op. cit.*, p. 744.

> As far back as 1947, the Soviet government accorded us a credit which amounts to 330 million rubles. The credit from the sister democracies is 345 million rubles. These credits have been sought for the following uses: 152 million rubles for the new industries, 132 million rubles for mining, 63 million rubles for transport, 24 million rubles for agriculture, and the remainder for various machines, bread grain, consumer goods, raw materials, fuel, and so on. . . . Because of the mistakes we have made in our investments in using the credits, and because of the failure to realise our plans, especially in mining and in agriculture, we are now in a very difficult situation in regard to repaying the credits we have received from our friends.[7]

The anticipated growth of the economy during the 1954–59 period was expected to make repayments even more difficult, export potential being estimated at 460 million rubles, of which 70 percent would have to go toward repaying the credits and interest. Further it was estimated that the import requirement for the same period would be 570 million rubles, a deficit in the visible balance of 110 million rubles.[8] Thus, it is clear that by 1953 the PLA leadership had moved further away from an attempt to develop the economy without recourse to aid and was planning to continue dependence on Comecon. The reasons for Comecon's persistent generosity in the face of a high probability that the debt would turn bad are unknown, and Wiles' conclusion that "Albania's performance can only be described as a remarkable diplomatic achievement" [9] cannot be disputed.

TABLE 1.—TOTAL ALBANIAN TRADE AT 1971 DOMESTIC PRICES

[In millions of leks]

	Albanian exports	Albanian imports	Imports-exports
1945	2.0	7	5.0
1946	7.5	8	.5
1947	19.0	121	102.0
1948	33.0	73	40.0
1949	24.0	52	28.0
1950	26.0	88	62.0
1951	37.0	159	122.0
1952	53.0	128	75.0
1953	45.0	161	116.0
1954	41.0	104	63.0
1955	52.0	172	120.0
1956	75.0	156	81.0
1957	117.0	214	97.0
1958	117.0	315	198.0
1959	136.0	342	206.0
1960	212.0	353	141.0
1961	211.0	314	103.0
1962	178.0	281	103.0
1963	209.0	308	99.0
1964	256.0	422	166.0
1965	270.0	469	199.0
1966	303.0	512	209.0
1967	317.0	523	206.0
1968	360.0	535	175.0
1969	368.0	661	293.0
1970	431.0	687	256.0

Source: See appendix.

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[7] E. Hoxha, *Selected Works* Vol. 2 (Tirana, 1975), pp. 390–391.
[8] *Ibid.*, p. 391.
[9] P. J. D. Wiles, *Communist International Economics* (Oxford, 1968), p. 400.

As table 1 shows, aid to Albania fell from 116 million leks in 1953 to 63 million leks the following year, and although Albania's difficulties may have been a factor it is more likely that the Soviet new course was the primary cause of the reduction. Indeed, whereas the Albanian trade deficit was 545 million leks for the years 1947–53, for the shorter period 1954–59 it was significantly greater at 765 million leks. Albania was released from repayments of all its debts by the Soviet Union in April 1957,[10] and a further credit of 300 million rubles was offered for the third 5-year plan.[11] When relations between Albania and the Soviet Union deteriorated this offer was withdrawn and all trade between the two countries ceased after 1961. Some impression of the influence on Albanian industrial development of Comecon aid may be gained from a consideration of the number and nature of new industrial enterprises commissioned in Albania between 1947 and 1961. Of 37 new enterprises, 8 may be characterised as belonging to branches of mining and heavy industry, while the remainder contributed to light or food industrial production.[12]

Since 1961 the major contributor of economic aid has been China. Table 2 shows the balance of trade between Albania and China between 1959 and 1964, no further official figures having been published.

TABLE 2.—ALBANIAN TRADE WITH CHINA CURRENT DOMESTIC PRICES

[In millions of new leks]

	Exports	Imports	Excess of imports
1959	12.1	24.1	12.0
1960	10.4	34.9	24.5
1961	13.9	97.4	83.5
1962	58.5	210.7	152.2
1963	116.8	208.4	91.5
1964	119.6	308.6	189.0

Source: M. C. Kaser, "Trade and Aid in the Albanian Economy," in Joint Economic Committee, U.S. Congress, "East European Economies Post-Helsinki," U.S. Government Printing Office (Washington, D.C., 1977), pp. 1325–1340.

Thus China provided 533 million leks during the first 4 years of the third 5-year plan and Kaser has estimated that Chinese aid for the whole period amounted to 728 million leks.[13] For the period 1959–75 he has estimated Chinese aid as $838 million at current prices, which compares favourably with Comecon aid between 1947 and 1961 of $389 million.[14]

To the extent that the Albanian Government has attempted to use aid for the development of heavy industry, Chinese aid appears to have been more appropriate than credit from Comecon. Thus, between 1962 and 1964 there were 12 new industrial enterprises commissioned of which only 3 were heavy industrial, Chinese aid probably being employed during this period to complete projects begun prior to the changeover, while between 1965 and 1970 there were 41 new enterprises opened. Of these, 24 contribute to heavy industrial output.[15]

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[10] M.C. Kaser, *op. cit.*

[11] *Ibid.*

[12] A list of construction projects completed between 1946 and 1970 is given in *Vjetari Statistikor i RPSh 1971–72* (Tirana, 1972), pp. 119–125.

[13] M.C. Kaser, op. cit.

[14] Ibid.

[15] Vjetari Statistikor i RPSh 1971–72, loc. cit.

However, the provision of aid which corresponds directly to the requirements of the government of a developing economy, in terms of its development strategy, is not the only criterion by which the utility of the aid may be judged. Whereas Albanian criticism of Comecon aid has invariably appeared since 1961, the Chinese were indirectly criticized in November 1976 when they were still providing the bulk of Albanian aid. Thus, in Mehmet Shehu's report to the Seventh Congress of the PLA it is noted that one of the factors determining the underfulfilment of the fifth 5-year plan's targets for industrial production was the failure to complete construction, on time, of several of the most important industrial projects.[16] Given that the most important projects tend to be those financed out of foreign aid it is possible that late Chinese deliveries were being indirectly blamed for the delays. It is impossible to test this hypothesis directly because Albanian officials insist that relations with China leave nothing to be desired.[17] On the other hand, the more explicit criticisms which appeared in *Zëri i popullit* on July 7, 1977,[18] concerning China's foreign policy suggest that there are problems in the relationship between the two countries and there is evidence of a Chinese refusal to grant Albania credit in 1975, suggesting that the large distance between the countries as well as China's internal political problems have led to delays in delivery scheduling. This issue is taken up in greater detail later in this paper.

Prior to an analysis of the impact of foreign aid on investment in Albania, a conceptual framework is necessary. In the following sections aid models designed for application to developing market economies are outlined and related to the Albanian experience. The combination of market theory and planning practice is then used to suggest the beginnings of a theory on the impact of economic aid on a developing centrally planned economy.

THE MACROECONOMICS OF AID

A basic prerequisite of economic growth is investment and thus savings. The absence of a sufficiently high level of savings to produce a desired rate of growth of output may be due to either system characteristics or the level of development. Thus, in an advanced market economy it may be that investible resources are available but that decentralized decisionmaking leads to relatively higher levels of current consumption than might be the case in an equally well endowed centrally planned economy. On the other hand if, regardless of the system rules determining the allocation cf resources the economy lacks the resources to generate sufficient investment and, thus, a desired rate of economic growth, it is clear that external sources of investment funds need to be found. The orthodox macroeconomics of aid is concerned primarily with the elucidation of models in which foreign capital is employed to meet the requirements of the developing economy by filling either of two so-called "gaps," viz the savings gap or the foreign exchange gap.

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[16] *Rruga e partisë*, No. 12, 1976, p. 15.
[17] Albanian interview material, May 1977.
[18] *Zëri i popullit*, July 7, 1977.

The savings gap may be explained with reference to the Harrod growth equation:

$$g = sk,$$

where g is the proportional rate of growth of national income, s is the proportion of income saved and invested, and k is the incremental output-capital ratio.

If a country receives a proportion "a" of national income as aid and all the aid is invested, the growth rate becomes $(a + s)k$. Assuming the "k" remains constant the rate of capital accumulation necessary to achieve a target rate of growth g^* is given by:

$$c = g^*/k$$

The savings gap is the amount of aid needed to supplement domestic savings if g^* is to be achieved, namely:

$$a = c - s$$

If the marginal propensity to save is greater than the average ($s' > s$), then a given inflow of aid will not only increase the rate of accumulation by supplementing domestic savings, but also raise per capita income and thus the proportion of income saved. In this case, the foreign aid has increased the economy's capacity for growth and it may be argued that eventually the target rate of growth will become "self-sustaining."

In the case of a developing economy it is generally assumed that in any given time period there is a fixed upper limit on the value of exports, $\bar{X}$. On the other hand, the requirement for imports is likely to be a function of national income, mY. The foreign exchange gap is defined as the difference between imports and exports and is positive if the desired level of growth demands imports greater in total value than exports. In proportional terms:

$$a = m - \bar{X}/Y$$

It should be noted that, in an ex-post sense, the foreign exchange gap must always equal the savings gap:

$$I + X \equiv S + M$$

i.e. $$I - S \equiv M - X$$

i.e. $$a = c - s \equiv m - \bar{X}/Y$$

On the other hand the ex-ante difference in magnitude of the two gaps will determine which is the binding constraint on growth. Thus, if the foreign exchange gap is the larger:

$$(m - \bar{X}/Y) > (c - s)$$

then domestic production levels may rise but the economy is assumed to be unable to produce the capital goods required for growth. Griffin [19] has argued that the degree of inflexibility assumed by the two-gap model is unrealistic; that in the long run "no economy is so rigid that it can produce neither capital goods, nor export goods nor import substitutes".[20] Thus, he argues, it is only a government's unwillingness to switch from production for consumption to export that makes foreign exchange appear as the binding constraint. "In other words, ultimately there can only be one constraint on investment, viz. savings".[21] Having thus eliminated the foreign exchange gap as a long-term problem, Griffin concentrates his attack on the savings gap formulation.

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[19] K. Griffin, op. cit., p. 102.

It is suggested that there are two unrealistic assumptions in the model. These are that the incremental output-capital ratio is invariant with foreign capital inflows and that foreign aid increases the level of investment by supplementing—an unchanged or increased level of—domestic savings. Griffin provides the following arguments to support his hypothesis that foreign credit will tend to reduce the incremental output-capital ratio. First, it is suggested the political objectives of donor countries often lead to aid being concentrated on "large, dramatic, highly visible projects which can stand as monuments to the generosity of the donors".[22] Second, it is assumed that aid agencies have an ideological bias against government ownership of directly productive activities. This leads to the provision of aid which "tends to alter the pattern of investment in favor of social overhead capital and economic infrastructure".[23] Third, it is argued that, for cost reasons, there is a greater likelihood of large rather than small projects being financed and finally, that the provision of tied aid often results in higher import—and thus domestic production—costs for the recipient of aid.

With respect to the impact of aid on domestic savings, Griffin argues that foreign capital inflows tend to supplement consumption rather more than investment and that the ready "availability of debt finance [from foreign sources] on soft terms may reduce the incentive of local investors to save".[24] It is further suggested that a government in receipt of aid may consequently increase the share of public consumption in its budget. Cross-section and time series data have been provided by Griffin and others in support of the argument.[25]

Griffin demonstrates his arguments diagramatically as follows:[26]

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[20] Ibid.
[21] Ibid.
[22] Ibid., p. 109.
[23] Ibid.
[24] Ibid., p. 107.
[25] Ibid., p. 106.
[26] Ibid., p. 110.

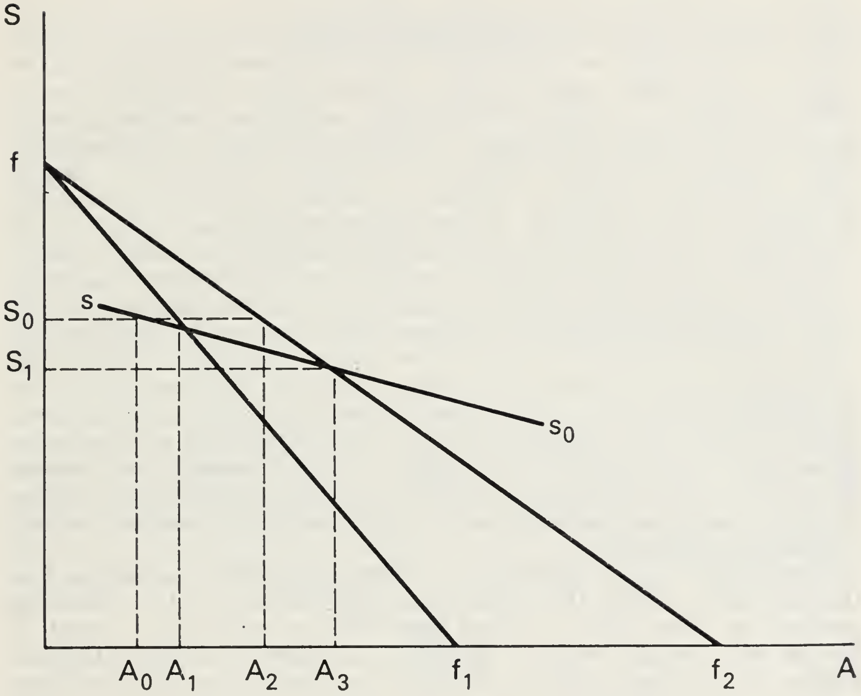

Diagram 1

The investment frontiers ff_1 and ff_2 indicate the various combinations of domestic and foreign savings that could be used to achieve a given target rate of growth, g*. The intercept on the vertical axis is determined by g* and by the k that would prevail if all investment were financed domestically. The value of the intercept is Y_0 (g*/k). The slope of the frontier depends on the extent to which capital imports affect the output-captial ratio. If foreign capital leaves k unaltered, the slope of the frontier will be minus 1, i.e. ff_1; if k declines the slope will be less steep, *e.g.* ff_2.
The line ss_0 is the domestic savings function. It is drawn in such a way as to suggest that domestic savings and capital imports are inversely associated. . . .
Assume initially there is S_0 amount of domestic savings and an inflow of public and private foreign capital of A_0. According to most macroeconomic aid models, additional capital imports of A_0A_1 would be needed in order to achieve the growth target. If one considers the adverse impact of foreign aid on the output-capital ratio, however, a much larger aid inflow would be necessary, viz, an amount equal to A_0A_2. But even this would not suffice if capital imports cause domestic savings to fall. In terms of [diagram 1], A_0A_3 amount of additional aid would be necessary to offset the decline in k and the fall in savings from S_0 to S_1.[27]

THE ALBANIAN EXPERIENCE

Although the two-gap model and Griffin's theory are both designed to explain the impact of foreign aid on developing mixed or pure market economies, an attempt to test the validity of these theories in explaining the effect of Soviet and Chinese aid on the Albanian economy provides a starting point for the development of a theory of aid in developing planned economies. The econometric estimation of the relationships between foreign aid and investment and between aid and the incremental output-capital ratio provides a reasonable test of both theories. If either a savings gap or a foreign exchange gap exists, the aid should have no discernible effect on the output-captial ratio, while in the Griffin case, the ratio should decline with increases in credit. If domestic savings is the binding constraint, then an increase in aid of \$A would be expected to yield an increase in investment of about the same amount, unless the marginal propensity to save is greater than the average, in which case the addition to investment will be slightly greater than \$A. If the foreign exchange gap is the binding constraint it is assumed that only an amount, say \$A of foreign aid, is aquired to supplement a prevailing rate of domestic savings to achieve a desired rate of growth. In other words, the additional foreign aid will allow a significant amount of savings which previously could not be converted into investible capital to be now so employed. Thus, if the ratio of imported to domestic investment funds is 'n', then an increase in aid of \$A will lead to an increase in investment of \$A/n.[28] However, since in practice no economy is ever so perfectly geared to the receipt of aid and the conversion of savings into investment, the amount \$A/n is also a maximum. In the Griffin case, any increase in aid will be met by a less than equal increase in investment, no change at all or, less likely, a decrease.

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[27] Ibid., pp. 110–111.

The problem of the reliability of Albanian statistics is discussed in the appendix, where the background calculations to the following analysis are also given. It seems reasonable to equate the extent of foreign aid flowing into the Albanian economy with the Albanian balance-of-payments deficit on current account since invisible flows both in or out of the country are likely to be very small and possibly only slightly in Albania's favor when the Soviet Union had a naval base at Vlora.[29] Thus the annual value of foreign aid (see table 1) is obtained by subtracting the value of exports from that of imports and since these are published in terms of current domestic prices, converting the series into constant prices for purposes of comparison—in this case, those of 1971. A gross investment series in 1971 prices has been published,[30] and is used in this study. It should be noted that Albania ceased publication of global trade statistics in the midsixties and although Kaser [31] has estimated the values of Albanian exports and imports up to and including 1970, no annual data on imports has been published or estimated for the years since 1970.

The Albanian industrial capital stock was estimated elsewhere by this author. However, the incremental output-capital ratios used in the present context must be calculated on the basis of the economy as a whole, since the estimates of foreign aid cannot be disaggregated by sector of use. Therefore, in this analysis it is measured as the ratio of the change in net material product to the value of gross investment in any particular year, and is valued in the constant prices of 1971. On the basis of these calculations two equations are estimated for various time series:

$$\Delta I = a \quad \Delta A + b, \qquad (1)$$

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[28] Ibid., p. 102.

[29] P. J. D. Wiles, op. cit., p. 402, values income from the base at around \$10 million relative to a visible deficit of \$40 million.

[30] Vjetori Statistikor i RPSh 1971–72, op. cit., p. 115.

[31] M. C. Kaser, op. cit.

$$\Delta\left(\frac{\Delta Y}{I}\right)=d\ \ \Delta A+e, \tag{2}$$

where I is gross investment, A is foreign capital inflow, and Y is net material product.

The equations are estimated for four important periods in Albania's economic development. The first covers the period from 1948 to 1961 when Albania's main source of aid was the Soviet Union. The second period under consideration is that of the Soviet presence in Albania between the first post-New Course year 1955 and the rupture of relations in 1961. The remaining two estimation periods relate to China as the major aid donor, 1961–66 being a time of adjustment to the change in external economic relations and 1962–77 covering the new period as a whole.

In the case of equation (2), the results are similar for all periods, the regression coefficient never being in excess of 0.1 and although all values of d were positive, none was greater than 0.001 and none was statistically significant. Thus, it may be concluded that foreign aid had no perceptible impact on the incremental output-capital ratio in Albania between 1948 and 1970. It is important to note, however, that this conclusion may be a consequence of the substantial assumptions involved in the evaluation of the incremental output-capital ratio as

$$\frac{\Delta Y}{I}.$$

Further, the empirical evidence in support of Griffin's hypothesis for other developing economies is somewhat limited.[32] Nonetheless, the result obtained is fully in accordance with the assumption of the two-gap model that

$$\frac{\Delta Y}{I}\ (\equiv k)$$

does not vary with aid.

In assessing the impact of a change in aid on changes in the level of investment, the following equations are obtained:

1948–61

$$\Delta I=\underset{(0.51)}{1.52}\ \ \Delta A+\underset{(26)}{70} \qquad R^2=0.372 \tag{3}$$

1955–61

$$\Delta I=\underset{(0.29)}{1.82}\ \ \Delta A+\underset{(16)}{103} \qquad R^2=0.865 \tag{4}$$

1962–70

$$\Delta I=\underset{(1.00)}{2.59}\ \ \Delta A+\underset{(50)}{67} \qquad R^2=0.416 \tag{5}$$

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[32] C.S. Voivodas, "Exports, Foreign Capital Inflow and Economic Growth", *J. Inter. Eco.*, Vol. 3, No. 1973, PP. 337–349.

1961–66

$$\Delta I_t = \underset{(1.21)}{4.19}\ \Delta A_t + \underset{(1.30)}{3.05}\ \Delta Y_{It-1} - \underset{(302)}{640} \qquad R^2 = 0.710 \tag{6}$$

where ΔY_{It-1} is the change in global industrial product lagged by 1 year. This variable was introduced to improve the poor fit obtained in its absence:

$$\Delta I = \underset{(1.70)}{3.43}\ \Delta A + \underset{(59)}{64} \qquad R^2 = 0.382$$

It should be noted that the incorporation of ΔY_{It-1} into the other three equations neither improved the fit significantly nor altered the coefficient a. The possible reasons for this are considered below.

Equation (3) shows that every additional $100 of aid to Albania during the Soviet presence yielded an increase of $152 in investment. However, if taken in conjunction with equation (4), it is suggested that the impact of aid was increased after the New Course, when absolute levels of foreign credit were reduced. Indeed, although the estimation of equation (1) for the 1948–54 period yields no statistically significant value for the relevant coefficient, the evidence of equations (3) and (4) makes it possible that it had a value close to unity during the period. The equation obtained was as follows:

1948–54

$$\Delta I = \underset{(1.04)}{0.93}\ \Delta A + \underset{(49)}{31} \qquad R^2 = 0.072$$

Thus, it is not clear whether the aid which Stalin gave Albania had a positive or negative effect on domestic savings, nor may any positive conclusion be drawn on the nature of the binding constraint. The relatively high import content of investments during the period would tend to depress the coefficient, while it is plausible that an economy as backward as was Albania at that time, with so generous a donor as the Soviet Union, might have greater difficulty in generating domestic savings than foreign exchange. It should be recalled that economic decisionmaking power was being centralized only very slowly during this period in Albania, the larger part of national income being generated by a private agricultural sector. Thus, it is tentatively suggested that until the Albanian Government was able effectively to procure the agricultural surplus as a result of changes in planning and the increasing pace of collectivization in the late fifties, the impact of foreign aid on the Albanian economy was similar to that of credit on mixed market developing economies. The major difference between these two situations would appear to be that, whereas aid to the market economies often leads to increased levels of current consumption via a relaxation of savings effort as argued by Griffin, Soviet aid came largely in the form of plant and machinery and was thus not fungible. Further, although the Albanian Government did not have complete control of the savings rate during this period, its ideological stance suggests that it would do anything feasible to insure the maximum conversion of aid into investment.

From 1955 onward, the nature of the growth constraint on the Albanian economy changed significantly; equations (4), (5), and (6) clearly are suggestive of the existence of a predominating foreign exchange gap. Although the benevolent nature of the donors and the low level of development of the Albanian economy had not changed markedly, the system rules had been altered sufficiently to ensure that the high savings rate demanded by the Stalinist development strategy could be effectively enforced. The different estimates of the "impact" coefficient in (4), (5), and (6) reflect the fact that, in the period immediately following the split with the Soviet Union, the import content of investment fell as the economy was adjusted from the almost exclusive utilization of Soviet and East European technology to a mixture of Comecon and Chinese production processes. As this adjustment process was unlikely to exceed five years, it is arguable that the decrease in "a" during the late sixties implied by equations (5) and (6) represents the increased import content of investment that accompanied high rates of growth of investment and output during the fourth 5-year plan (1966–70).

The positive influence of lagged industrial output during 1961–66 represents a change in the Albanian Government's approach to the related issues of foreign aid and self-sufficiency. Namely, during this period changes in the level of investment were partially financed out of increases in domestic output, implying that the Government decided to attempt to sustain economic growth without recourse to the same level of foreign assistance as had previously been the case. The already mentioned reduction in the import content of investment would support this argument. The size of theΔY_{It-1} coefficient (3.05) indicates the relatively low proportion of gross industrial output in gross domestic product. Thus, for every $100 increase in industrial output, there would be an additional $205 forthcoming from other sectors which could be converted into investment funds. Between 1961 and 1966 the contribution of industry to net material product in Albania averaged one third, thus the coefficient estimated would be consistent with a marginal propensity to save through the period of very nearly unity. This result indicates that the rather large standard error of the estimate (1.30) is significant. On the other hand, it is clear that the Albanian Government cannot have been certain that aid to replace that from the Soviet Union would be so readily available in the future. The failure of changes in output to influence investment in equation (5)—the relevant coefficient being 0.12 with a standard error of 0.19—signals a return to the former dependence on foreign aid for investment in the Albanian economy in the late 1960's. The high rate of growth of industrial production during the fourth 5-year plan (83 percent) as against that achieved during the previous 5 years (39 percent) was probably instrumental in convincing the Albanian authorities that reliance on generously donated aid was a more practical policy—notwithstanding the rhetoric of self-reliance—than ideologically motivated abstinence.

THEORETICAL IMPLICATIONS

The Albanian experience of foreign aid suggests that neither the two-gap model nor Griffin's alternative are entirely suitable as explanatory theories. To the extent that the Albanian economy has exhibited both savings gap and foreign exchange gap behaviour it may seem that the two-gap model is plausible. This is enforced by the finding that foreign aid does not appear to have affected the efficiency of capital utilization in the economy. However, the assumption of functional relationships between the major variables in the model need not hold for a centrally planned economy, since most macroeconomic variables are determined according to planners' preferences. Thus, there is no theoretical reason why gross investment should be positively correlated with either foreign aid or domestic capital goods production because the annual rate of investment is determined centrally and is the result of both economic and political considerations. On the other hand, the availability of funds places an upper limit on the level of investment. The two-gap model gives a reasonable fit for the impact of aid on the Albanian economy because its two basic assumptions are fortuitously correct. First, the assumption that the rate of growth will increase if the ratio of investment to national income rises is likely to be true where ideological factors demand that ever increasing proportions of investment funds be allocated to the production of capital goods. Second, it will generally follow that the rate of investment rises as capital imports increase if the government of a centrally planned economy is determined that it should be so and is able to insure that domestic resources have been allocated in such a way as to facilitate the rapid absorption of the imported capital into the production process.

It was noted above that, according to Griffin, in the long run no economy is so inflexible that a foreign exchange gap need exist. The foreign exchange gap formulation argues that the economy is unable to attain a desired rate of growth because the production of exports—or import substitutes—is not sufficiently high to pay for the required imports. It is the centralization of economic decision-making which again poses a problem in this case, since Albania's foreign exchange gap may be voluntary, the Albanian Government being prepared to run a deficit in its balance of payments so long as generous aid is forthcoming. To the extent that this argument holds, the gap may be illusory. The political constraints on the choice of trading partners for a socialist economy may add to this illusion.

Griffin's theory is not appropriate for the study of centrally planned developing economies for the same reason that the two-gap model appears to provide good results, namely, that the assumptions he makes concerning aid leakage to current consumption and diminishing efficiency of capital utilization are inconsistent, quite by chance, with a Stalinist development Strategy. His analytical framework may, however, be used to illustrate the Albanian experience.

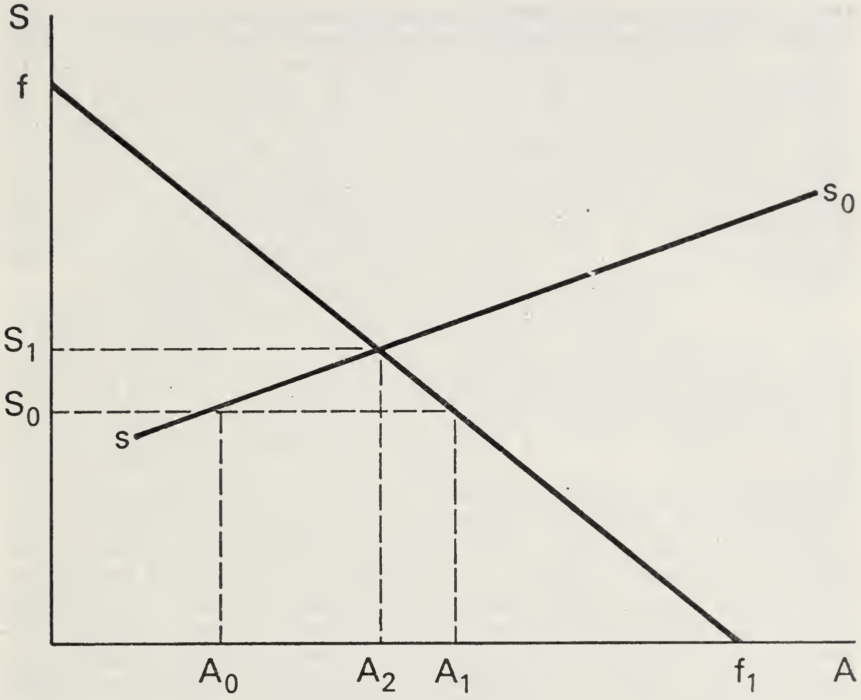

Diagram 2

In diagram 2, as in diagram 1, ff_1 indicates the various combinations of domestic and foreign savings which could be used to achieve the desired rate of growth, g^*, on the assumption that the incremental output-capital ratio is invariant with foreign capital inflows. The domestic savings function is shown as increasing with increasing levels of foreign aid. In this case, assuming the initial values of domestic savings and foreign savings to be S_0 and A_0 respectively, the two-gap model would predict that an additional amount of aid A_0A_1 is required to achieve g^*, whereas according to Griffin significantly more would be needed. In the Albanian case, however, an amount A_0A_2, which is less than A_0A_1 would be required to achieve the same growth target.

In the discussion thus far, the theoretical implications of donor motivation have not been considered. The two-gap model ignores the problem, assuming implicitly that economic aid has no political implications, while Griffin argues that aid agencies in the developed capitalist economies are likely to provide aid which both retards economic growth and favours the private ownership of the means of production. If Griffin's hypothesis is correct, it may help to explain why centrally planned economies such as Albania and at an early stage North Korea[33] have sought aid largely from other socialist economies since state and group forms of ownership predominate in these economies and the prevailing development strategies require that foreign aid supports economic growth. Government sensitivity with regard to the relationship between the nature of foreign aid and the development strategy may have been an important factor in the split between Tirana and Moscow. The Albanian press has repeatedly accused the Soviet Government of attempting to hinder the development of heavy industry in Albania, it being claimed that Soviet economic aid was intended primarily to make the Albanian economy a dependant part of Comecon. The important point is not the accuracy or otherwise of the accusation, rather the importance of political variables in the Albanian solution of foreign trade problems.

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[33] North Korean development is discussed in J. Robinson, "Korean Miracle", *Monthly Review*, January 1966, pp. 541–549. However, since the mid-sixties North Korea has borrowed heavily in the West.

Thus, if it is possible to generalize from the Albanian experience, it may be argued that, if a donor exists who will provide the kind of aid compatible with a Stalinist development strategy—in other words, plant and machinery for the production of capital goods—it is likely that increasing levels of aid will lead to an increased rate of growth of output. If such a donor cannot be found, aid is nonetheless likely to support growth but there may be considerable political instability in the relationship between donor and recipient with the consequent loss of unpaid credits should a more suitable donor become available. In this situation, the developing economy may have to bear the economic and social costs of adjusting to a different production technology. The crucial assumption which must be made in predicting this scenario is that the developing economy is not politically dependant on the donor. Thus, whereas it was possible for Albania to break its ties with the Soviet Union, it would probably not be feasible for, say, Mongolia to do so. The experience of both North Korea and [North] Vietnam suggests that the terms of aid receipt may be improved if more than one donor is competing for political influence in the developing country.

FOREIGN AID AND SELF-RELIANCE

It was noted above that the basic assumption of the two-gap model is that as capital imports increase the investment rate will rise with positive implications for the rate of economic growth; it was suggested that this assumption is also expected to hold true for a socialist centrally planned economy developing along Stalinist lines. To the extent that aid allows the attainment of a desired rate of growth, g^*, it is to be expected that if the marginal propensity to save is larger than the average by more than the size of the savings gap, then the target rate of growth will eventually become "self-sustaining." If a foreign exchange gap is the binding constraint and the size of the savings gap is considerably less, so that increases in the amount of aid have a marked impact on investment, the growth rate g^* would become "self-sustaining" more rapidly still. In a market developing economy with no influential political ties with the donors, it might be expected that as the possibilities for self-reliance rose the level of aid would automatically fall, either as a direct consequence of an increasing supply of exports or a decrease in the demand for imports.

In a socialist economy various political and ideological factors are likely to complicate the situation. According to Stalinist economic ideology, a socialist economy must maintain a high rate of growth insuring that the rate of growth of capital goods production exceeds that of consumer goods output. Consequently, the PLA leadership argued that the pattern of investment must be such as to encourage the development of heavy industry. On the other hand, as the discussion in the previous chapter showed, the Albanian economy was not able to increase the share of heavy industrial output in total industrial production until the fourth 5-year plan, 1966-70, because a set of priorities for the development of the various branches of heavy industry had not been determined and because the large part of Soviet aid was directed into other sectors. Thus, although it may have been possible for the Albanian economy by, say, 1965 to sustain an acceptable target rate of growth without recourse to further aid, the pattern of growth implied by a policy of self-reliance would have run counter to the ideologically determined development strategy.

However, even if heavy industry had been developed to a sufficiently high level by, say, 1965 the problem of what an acceptable target rate of growth would be in a socialist economy remains. Stalin's "fundamental law of socialism" suggests that the target rate would be very high. It may usefully be quoted:

> . . . the securing of the maximum satisfaction of the constantly rising material and cultural requirements of the whole of society through the continuous expansion and perfection of socialist production on the basis of higher techniques.[34]

Thus, if the Government settled on a fixed target rate g^*, it would be doing so on the assumption that the set rate was sufficiently high to take account of "the constantly rising material and cultural requirements" and that the economic base was sufficiently well developed to allow "perfection of socialist production on the basis of higher techniques". It has been argued elsewhere [34a] that the Albanian notion of self-reliance strongly implies dependence on existing imperfect levels of technology. In other words, whereas the formulation of a development strategy requiring a growing capital-labour ratio implies embodied technical progress, Albanian innovatory schemes are likely to represent disembodied technical progress. Hence it is likely that a socialist economy at the Albanian level of development would continue to require foreign aid, when a similarly placed mixed market economy ceased to do so.

From a political viewpoint, the continued granting of aid by a donor such as the Soviet Union may yield benefits in terms of increased influence within the socialist bloc which more than compensate for the cost of the aid. Thus, the sharp increase in aid to the Albanian economy in 1950 was probably due more to an attempt by the Soviet Government to convince the PLA leadership that it had acted correctly in breaking with Yugoslavia, than any economic motivation. But by 1956 the Soviet Union wanted to change to a "pay-off" approach and recommended that the Albanian economy expand fruitgrowing and other agricultural sectors. It is arguable that the decision to convene the Comecon Council in Tirana showed this shift to getting some economic return from Albania. In the light of events that followed, it is conceivable that Hoxha did not want to give a return. It is possible that many of the underdeveloped countries which have made a political swing in foreign relations have done so in order to renege on debts to former aid-donors.

Political factors and the nature of the planning system may account for the receipt of higher levels of foreign aid then the donor has anticipated. Thus, in attempting to explain Albanian's success in being permitted to maintain a balance-of-payments deficit throughout the 1950's, Wiles[35] has argued that following the signing of trade agreements with other Comecon countries, the Albanians intentionally underfulfilled their export plan. He provides the following table of GDR-Albanian trade statistics in support of his argument:

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[34] J. V. Stalin, *Economic Problems of Socialism in the U.S.S.R.*, (Peking, 1972), pp. 40–41.

[34a] A. Schnytzer, *Economic Planning & Industrial Policy in the People's Republic of Albania* (unpublished D. Phil. Dissertation, Oxford, 1978), p. 110.

TABLE 3.—GERMAN DEMOCRATIC REPUBLIC TRADE WITH ALBANIA

[Thousands of old valuta roubles]

	GDR exports			GDR imports		
	Contracted	Actual	Actual as percent of contracted	Contracted	Actual	Actual as percent of contracted
1952	9, 315	9, 530	102	1, 160	1, 890	163
1953	12, 008	11, 615	97	3, 291	2, 489	76
1954	14, 179	8, 622	61	3, 941	2, 314	59
1955	22, 880	24, 232	106	9, 400	5, 070	54
1956	15, 914	16, 696	105	8, 074	6, 612	82
1957	24, 027	17, 068	71	11, 195	9, 113	81
1958	24, 668	21, 969	89	18, 710	10, 150	54
1959	27, 307	27, 700	101	23, 883	19, 172	80

Source: F. L. Pryor, "Communist Foreign Trade System" (London 1963), p. 192.

If Wiles' hypothesis is correct, it should be noted that the Soviet new course probably accounts for the GDR's severe underfulfillment of this part of its export in plan in 1954. On the other hand, Albania's failure to meet her plans after a surprisingly auspicious beginning may also be explained by the generally ambitious nature of Albanian planning during that period and the consequent inability of the export-producing sectors of the economy to cope with the taut planning. That this hypothesis is possibly more likely than Wiles' is suggested by the comparison in table 11 between the annual percentage increase in Albanian exports to the GDR between 1952 and 1959 and the percentage rise in total exports.

TABLE 4.—ALBANIAN TRADE WITH GERMAN DEMOCRATIC REPUBLIC

[Annual percentage increments]

	1953	1954	1955	1956	1957	1958	1959
Exports to GDR	32	−7	119	30	38	11	89
Total exports	−16	−7	28	43	56	1	16

Source: Tables 1 and 3.

The coefficient of correlation between these two series is sufficiently low at 0.33 to suggest that an evaluation of Albanian Government motivation with respect to aid inflation on the basis of data for trade with the GDR alone may be misleading.

Finally, it should be noted that the available evidence on Albanian investment and aid receipts does not allow the conclusion that the Albanian economy has come closer to a state of self-reliance as a consequence of increased foreign aid, even though aid has contributed substantially to economic growth. Thus, taking the ratio of foreign aid to gross investment as a measure of the extent of Albanian self-reliance the following average values in table 13 are obtained for the first 5-year plans.

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[35] J. D. Wiles, *op. cit.*, p. 402

TABLE 5.—RATIO OF FOREIGN AID TO GROSS INVESTMENT

Plan period	1951–55	1956–60	1961–65	1966–70	1971–75
Foreign aid/gross investment	0.23	0.17	0.11	0.12	0.15

Source: See appendix.

If the above ratio gave a measure of the extent to which foreign aid had helped the Albanian economy become self-reliant, it would appear that the aid was initially positively influential in that direction, but has been detrimental since 1966. However, as the above arguments have shown, the decision to run a balance-of-payments deficit may be as much political and ideological as purely economic and the official Albanian claim that a major feature of Albania's development strategy is self-reliance is not borne out by these results. On the other hand, it may be that a realization of the gap between theory and practice on the part of the PLA leadership, together with dissatisfaction over the timing of Chinese deliveries in recent years has led the Albanian Government to reduce its dependence on capital imports from China.

A recent article in *Zëri i popullit* [36] criticized various of the theories underlying China's foreign policy, although China was not mentioned by name. In particular, it was argued that the United States and the Soviet Union were equally dangerous superpowers and that the Third World could not be considered as a shield to their power. Later in July, reports from Belgrade suggested that the Albanian Government had asked Chinese experts to leave Albania while official sources in both Tirana and Peking denied the reports.[37] On the other hand, the Chinese press attacked what it called "splitism" in Albania. From the viewpoint of economic aid there was a significant report broadcast by Radio Tirana on July 26, which contended that the Albanian Government had asked the Soviet Government for credits to assist in the construction of the metallurgy complex at Elbasan in 1960 and that they had been refused. The likely validity of this contention is supported by the fact that Romania's request to the U.S.S.R. for a steel plant at Galati was also turned down at the same time.[38] Moreover, the Czech Government had earlier said that it could supply all of Albania's steel requirements if it received Albanian iron-nickel ores.[39] The report went on to add that the Albanians were thus forced to build the complex relying on their own resources and that this had been successfully achieved up to now. That the project could not have been undertaken without Chinese aid was not mentioned. In fact, the Chinese were not thanked for aid at all. Although there is insufficient evidence available to be certain about the state of relations between China and Albania in 1977 it is possible that unless they improve, Albania may be forced to embark on a policy of self-reliance with all that it implies for the already low level of current consumption in the country.

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[36] *Zëri i popullit*, July 7, 1977.

[37] *The Times*, July 27, 1977.

[38] M.C. Kaser, "Comecon: Intergration Problems of the Planned Economies" (London, 2d. ed., 1967). p. 106.

[39] *Zëri i popullit*, Apr. 30, 1976

If the PLA leadership decides that Albania should maintain a balance of foreign trade, it is possible that a large part of that trade will be with the developed capitalist economies of Western Europe. The agreement signed between the Albanian and Greek Governments [40] to open a Tirana-Athens air link may have been a first step in this direction. However, should Albania's pattern of trade alter in this direction and should China lose the status, in the Albanian press, of a socialist economy, any future Albanian requirement for foreign credit would pose the PLA constitutional problems for article 28 of the constitution states:

> The granting of concessions to, and the creation of foreign economic and financial companies and other institutions or ones formed jointly with bourgeois and revisionist capitalist monopolies and states as well as obtaining credits from them are prohibited in the People's Socialist Republic of Albania.[41]

As Kaser has pointed out, "no government in the world has ever asked its legislature constitutionally to disbar it from raising an external loan." [42] On the other hand, the move is fully consistent with Albanian's development strategy and may prove to be equally flexible.

CONCLUSION

On the basis of the discussion throughout this paper it is possible to draw conclusions which relate to both the theory of economic aid and the Albanian experience. Theoretically, it might be expected that an underdeveloped economy in which a Stalinist government comes to power, would display savings gap behaviour while ownership of the means of production remains private and the government has not gained control over the agricultural surplus. On the other hand, as nationalization and the central planning system develop in complexity, a sufficiently high rate of domestic savings, coupled with a desire to give priority to industrial development, may give the impression that a foreign exchange gap is the binding constraint. It may be, however, that this is a self-imposed constraint, the target rate of growth being set somewhat higher than it might be in a mixed market economy at a similar level of development.

A study of the Albanian experience also suggests that a theory of aid which does not take account of ideological and polictical factors can never fully explain the impact of aid on a centrally planned developing economy. The Albanian split with the Soviet Union provides the most dramatic illustration of this point.

From a practical point of view, it seems reasonable to conclude that, while Albania has been able to maintain a reasonably steady flow of external credit throughout the past 30 years, the aid has nonetheless acted as a constraint on Albanian industrial policy in two important respects. First, the aid received from Comecon assisted the development of light industry in Albania at the expense of heavy industry, notwithstanding the implied benefits for Albanian exports. It also operated to the detriment of agriculture up to 1953, but this appears to have been a failure of PLA policy rather than a constraint imposed by donor motivation. Second, the aid provided by China seems to have been fully in accord with a Stalinist strategy, but the geographic problems involved in commodity transport between China and Albania and China's instability as an aid donor may account for Albanian difficulties in completing the construction of industrial projects within a planned time.

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[40] The Times, July 19, 1977.

[41] *Kushtetuta e Republikës Popullore Socialiste të Shqipërisë* (Tirana 1976), pp. 20–21.

[42] M. C. Kaser, in Joint Economic Committee, *op. cit.*

APPENDIX. ALBANIAN STATISTICAL SOURCES

INTRODUCTION

The quantity of official Albanian statistics published is roughly correlated with Albania's economic position in the socialist world. Thus, it publishes fewer statistics than the relatively developed economies of Eastern Europe but rather more than the underdeveloped economies of Asia. Statistical yearbooks were published annually up to 1965 and appeared biennially between 1967–68 and 1971–72. Since that time, there has only been one statistical publication of note, *30 vjet Shqipëri socialiste*, (Tirana, 1974), an *ersatz* yearbook. It is not clear whether further statistical yearbooks will be published in the near future.

The reliability of Albanian statistics cannot be measured directly on the basis of available evidence. However, it is likely that inaccuracies will arise due to distortion at the enterprise level—a common feature of other East European statistics. It seems unlikely that statistics are deliberately distorted at the central level for two reasons. First, with respect to the statistics used in this thesis there is little evidence of inconsistencies between various sources. Such discrepancies as do occur may be ascribed to rounding errors or changes in methodology. Second, sufficient economic failures have been published to indicate that the reported successes are plausible. In the case of a particularly undesirable outcome the datum is not reported and must be calculated indirectly.

For the purposes of most of the statistical analysis in this paper it has been necessary to convert particular data published at current prices into a constant price series. The relative scarcity of statistics generally precludes any choice between alternative methodologies in the calculation of price indices. Consequently, it has proved necessary in most cases, to estimate the only index possible. In the Albanian case, this is unlikely to be crucial as almost any index chosen—if the choice were available—would suffer from a defect certain to outweigh all others; namely, that the rapid growth of the Albanian economy since 1945 has been accompanied by a marked change in the composition of aggregates such as global industrial production and gross investment.

The decision to convert all aggregates into 1971 prices has, likewise, been determined by the nature of Albanian statistical publications. Thus, values for global industrial product are generally given in 1956, 1960, 1966 or 1971 prices since these were years of reforms in industrial wholesale prices. On the other hand, for reasons which are not clear, gross investment has been valued at 1958, 1961 and 1971 prices. For the sake of consistency, then, 1971 prices must be used. The unavoidable problem caused by this constraint is that where absolute values of a particular variable have not been published, it has been necessary to use growth indices based on a Laspeyres formula, which employs base-year (probably 1956) price weights, for example:

$$\frac{p_1 q_0}{p_0 q_0} \qquad \text{(\textit{Statistika ekonomike}, (Tirana, 1972), p. 148)}$$

On the basis of the foregoing discussion it is clear that, as yet, statistical calculation at a level of sophistication encountered in research on other East European economies is not possible. On the other hand, to the extent that the statistical data used in this paper have not been in conflict with qualitative expectations, it may be argued that the manipulations required to produce the data in its final form have been justified. The remainder of this appendix is devoted to an outline of the sources and methods used in the preparation of the tables in the body of the text.

A. Table 1

M. C. Kaser, "External Economic Relations", in M. C. Kaser and A. Schnytzer, *The Albanian Economy from 1945 to the 1980 Plan* (Papers in East European Economies, n. 52, St. Antony's College, Oxford), p. V–13, gives the value of Albanian exports and imports, at current prices, over the relevant period. A former employee of the Albanian Planning Commission (Mrs. A. Palacios, St. Antony's College, Oxford) has stated that the value of Albanian imports is expressed in domestic prices. Since no official Albanian source gives a contradictory impression, it is assumed that a simple price index may be used to convert the trade data into 1971 prices. The index chosen is calculated on the basis of data relating to gross industrial production because the analysis in chapter 5 is concerned only with the surplus of imports over exports as a measure of foreign capital inflow. The content of the surplus may thus be reasonably assumed to comprise predominantly industrial goods. Finally, it is assumed that an index relating 1956 to 1971 prices may be applied to the pre-1956 data.

Vjetari statistikori RPSh 1967–8 (Tirana, 1968), p. 54, gives the value of global industrial production in 1967 as 5260.2 million leks at 1966 prices. On the basis of the annual rates of growth of global industrial output given in *Vjetari statistikor i RPSh 1971–72, op. cit.*, p. 56 and the absolute value for 1965 in 1971 prices (*Ibid.*, p. 55) the value of global industrial product in 1967 at 1971 prices may be calculated at 4874.9 million leks. Dividing the two 1967 values gives a price index of 1.079 by which all current price trade data between 1966 and 1970 may be divided to yield the relevant figures in Table 1.

Similarly, the value of global industrial production for 1960 in 1971 and 1956 prices given, respectively, in Ibid. and *Vjetari statistikor i RPSh 1965* (Tirana, 1965 p. 126) are used to calculate a deflator of 12.47. *Ibid.*, p. 127 expresses 1960 global industrial production in 1960 prices, facilitating the calculation of an index linking 1960 prices with 1971 prices. The value of the index is 0.08699.

B. Table 5

The ratio of foreign aid to gross investment is calculated on the basis of Table and the investment series in *Vjetari statistikor i RPSh 1971–72, op. cit.*, p. 115. This source is used in conjunction with *Rruga e partisē*, No. 12, 1976, p. 11, which states that gross investment for the years 1971–75 was 50 percent greater than it had been in the 1966–70 period, to calculate the value of A/I for 1971–75.

C. Econometric Estimations

The econometric estimates given in this paper were all obtained using the "Fakad" program on the Oxford University computer. The program gives all R^2 values corrected for degrees of freedom. The values of Y_{It-1} used in equation (6) were calculated on the basis of the price indices noted above and are presented in the following table:

TABLE I.—*Lagged global industrial product (mn. leks at 1971 prices)*

1960	281
1961	195
1962	195
1963	214
1964	259
1965	225

The values of A follow from Table 1, while the investment series is from *Vjetari statistikor i RPSh 1971–72, loc. cit.*

For the regression of incremental output-capital ratios on foreign aid, the value of net material product for the relevant years was calculated on the basis of the 1970 estimate in 1971 prices given by M. C. Kaser and A. Schnytzer, *op. cit.*, p. I–21 and the indices of annual growth of net material product found in *30 vjet Shaipēri socialiste, op. cit.*, p. 183, *Ekonomia popullore*, No. 6, 1972, p. 119, *Vjetari statistikor i RPSh* 1969–70, *op. cit.*, p. 105, *Vjetari statistikor i RPSh 1965, op. cit.*, p. 345 and *Anuari statistikor i RPSh 1960* (Tirana, 1960), p. 276. The calculated values of $\Delta Y/_I$ are shown in the following table (1971 prices):

TABLE II.—INCREMENTAL OUTPUT-CAPITAL RATIO

1956	0.050	1961	0.218	1966	0.295
1957	.534	1962	.218	1967	.330
1958	.176	1963	.383	1968	.112
1959	.462	1964	.183	1969	.301
1960	.077	1965	.002	1970	.242

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